STEEL

PRODUCTION • PROCESSING • DISTRIBUTION • USE

For forty-eight years—IRON TRADE REVIEW

EDITORIAL STAFF
E. L. SHANER, *Editor*
E. C. BARRINGER, *Managing Editor*
E. C. KREUTZBERG, *Engineering Editor*

ASSOCIATE EDITORS
A. J. HAIN, G. H. MANLOVE, E. F. ROSS, J. D. KNOX, A. H. ALLEN

New York B. K. PRICE—L. E. BROWNE
Pittsburgh . . . E. A. FRANCE JR.
Chicago . . . . . W. G. GUDE
Washington . . . . . L. M. LAMM
London . . . . VINCENT DELPORT

Published by
PENTON PUBLISHING CO.
PENTON BUILDING
CLEVELAND, O.

JOHN A. PENTON, *Chairman of Board*
C. J. STARK . . . . . *President*
J. D. PEASE . . . *Vice President*
F. V. COLE . . . . . *Secretary*

BUSINESS STAFF
GEORGE O. HAYS, *Business Manager*

New York
J. F. AHRENS, E. W. KREUTZBERG

Pittsburgh . . . . S. H. JASPER
Chicago . . . . . L. C. PELOTT

Cleveland
JOHN HENRY, R. C. JAENKE

R. T. MASON, *Circulation Manager*

Contents . . February 25, 1935

Volume 96 ◆ Number 8

AS THE EDITOR VIEWS THE NEWS..... 9

NEWS OF THE WEEK:

Steel Corp., Bethlehem To Spend $67,000,000..... 10
See Little Change for Steel Code..... 11
Bethlehem Pensions $7,000,000 in 12 Years..... 11

Institute 12
Production 12
Merger 12
Steel in the News..... 12
NRA 73
Financial 73
Labor 74
Users' Activities 74

Light Steel Leads in 1934 Output..... 13
Mirrors of Motordom..... 14
Windows of Washington..... 16
Obituaries 17
Industrial Men in the Day's News..... 18
Tracing Origin of Iron Deepens Its Antiquity, Part II.. 20

EDITORIAL—Congress Hostile to Industry..... 23
THE BUSINESS TREND..... 24

ENGINEERING DEVELOPMENTS:

Machine Tool Materials.... 26
Ball Bearing Maintenance 29
Light Metals, Alloys—III 31
Methods and Materials.... 35
Sprayed Metal Coatings.... 36
Parts for "Flying Yankee" 37
X-Ray Inspection 38
Silicon Carbide 39
Iron Oxide in Slags 42
Progress in Steelmaking 44
A.I.M.E. Meeting Report 46
New Equipment 49
Trade Publications..... 53

MARKET REPORTS AND PRICES.....55-74
CONSTRUCTION AND ENTERPRISE..... 75
ADVERTISERS' INDEX 82

BRANCH OFFICES:

New York . . . . . 220 Broadway
Chicago . . . . Peoples Gas Building
Pittsburgh . . . . . Oliver Building
San Francisco . . . . 441 Merrit Ave., Oakland, Calif., Tel. Holiday 4290
Washington . . . National Press Building
Cincinnati . . . 418-420 Sinton Hotel
London . . . . . Caxton House Westminster, S. W. 1
Berlin . . Berlin, N. W. 40, Roonstrasse 10

Member Audit Bureau of Circulations; Associated Business Papers Inc., and National Publishers Association.

Published every Monday. Subscription in the United States, Cuba and Mexico, one year $4, two years $6; in Canada one year $6.60, two years $11.20; in Great Britain and European countries, one year £2.

Entered as second class matter at postoffice at Cleveland under the Act of March 3, 1879.

Copyright 1935 by Penton Publishing Co.

HOW WELL HE WELDS depends on you..

The Wellman Engineering Co., Cleveland, Ohio, builds bedplate of rolled and cast steel by welding with Lincoln welders and "Fleetweld" electrodes.

EVERY competent welding operator takes pride in his work...will jump at the chance to produce better welding for you. Too many are handicapped by obsolete machines which have neither the capacity—the proper current characteristics—nor the efficiency to permit faster and improved welding at less cost.

If this is your responsibility, we suggest that you find out now how much easier, how much faster, and how much cheaper your operators can weld with "*Shield-Arcs*." These faster welders are guaranteed three ways to produce more welding per dollar. Ask for proof from The Lincoln Electric Company, Cleveland, Ohio. Largest Manufacturers of Arc Welding Equipment in the World.

W-106

LAD "S'matter, Pop? Got ants in your pants?"

POP "I've got more trouble than putting pants on ants. The shop ran out of 'Fleetweld' so they used some other kind of rod . . . now we've got to chip out about 35 feet of weld metal 'cause it doesn't test up to the standards set by 'Fleetweld'."

LINCOLN

"SHIELD-ARC" WELDERS

STEEL
PRODUCTION • PROCESSING • DISTRIBUTION • USE

As the Editor Views the News

A SINISTER hint of the powerful forces industry will be obliged to combat in order to block the passage of the obnoxious Wagner disputes and the Black 30-hour bills is found in the startling vote of the senate in approving the "prevailing wage" amendment to the President's work relief bill. The narrow 44 to 43 majority is not a true measure of the strength of A. F. of L.; several intricate political considerations also were involved. Nevertheless, the pressure of the federation bloc was a major factor. The shock of this action may serve to convince industrial leaders that congress is more hostile to industry (p. 23) than the administration.

• • •

A peculiar by-product of the present attitude of Washington toward holding companies and "bigness" is the revival of the perennial rumor that United States Steel is contemplating the removal of its offices from New York to Pittsburgh. In the light of the recent halting of the Republic-Corrigan, McKinney merger, the proposal for taxing large corporations heavily, the holding company bill and similar developments, the speculation seems more plausible than heretofore. If any of this legislation is enacted, some realignments in industry will be inevitable. One wonders if certain corporations will not attempt to soften the effect of definite government action by revamping their organizations before the blow falls.

Is "Bigness" Threatened?

• • •

Of the many significant features of metallurgical progress discussed last week before the American Institute of Mining and Metallurgical Engineers, none appeals more to the imagination than the possibilities of petrography, as outlined (p. 46) by Earl C. Smith, Republic's chief metallurgist. By studying petrographs, steelmakers can know what is going on in the furnace "more accurately, more rapidly and more reliably than by lengthy chemical analysis." Mr. Smith's statement that the use of petrographs has enabled Republic operators to increase production from 2 to 3 per cent will challenge the attention of every steelmaker. It may properly revive interest in the study of contamination of steel by refractories. That the industry needs linings "inert to molten metals and slags, insensitive to heat shock and capable of working at 3500 degrees" also should further stimulate research in refractories.

Petrography in Steelmaking

• • •

A wealth of illuminating discussion on trends in blast furnace practice enlivened the sessions of the metallurgical society. In retrospect, it is surprising how much the functions of blast furnace operation have been changed in recent years (p. 48) to meet the conditions of the depression. The papers on ores and fuels also showed how the status of their supply and consumption constantly is changing, due to numerous unstable economic factors. . . . Change likewise is the rule in the specification of materials for machine tools. A report on the forms and analyses of irons and steels used in modern equipment (p. 26) shows how the availability of many varieties of these materials has given the design engineer far greater latitude in selection.

Change Is Order of Day

• • •

For diversion from the vexing problems of the day we recommend the reading of the abstracts from "Iron, Prehistoric and Ancient," now appearing in STEEL. Interesting, informative and as accurate historically as painstaking research can make it, the text (p. 20) frequently affords proof that economic difficulties strikingly similar to our current ones were experienced in the iron industry many centuries ago. No one will fail to see the parallel between the speculative excesses following the wars of Alexander or the "corner" on iron executed by a Sicilian banker in the fourth century (p. 22) and the foolhardy actions which followed the world war of the twentieth century and led to the present depression. Mr. Richardson has made an important contribution to the history of the primitive iron industry.

Speculating in Iron, 330 B. C.

E. L. Shaner

Steel Corp., Bethlehem Spend $67,000,000 Modernizing

STEELWORKS modernization received encouraging impetus last week when the United Steel Steel Corp. authorized its subsidiaries to spend $47,000,000 for improvements, alterations and new equipment, and the Bethlehem Steel Corp. confirmed the award to the Mesta Machine Co., Pittsburgh, of a continuous strip-sheet mill at its Lackawanna (Buffalo) plant entailing an aggregate outlay of about $20,000,000.

These two leading steel producers, in point of capacity, thus have accounted for more than half of the $100,000,000 it was estimated (STEEL, Dec. 17, p. 14) the steel industry would spend this year for new equipment and nullifying obsolescence.

Third largest steelmaking interest—Republic Steel Corp.—has hinted at the construction of a continuous strip-sheet mill at the Corrigan, McKinney Steel Co., Cleveland, but its acquisition of this company is under fire by the government and any extensions thus are stymied.

Other Producers Buying

Jones & Laughlin Steel Corp., Pittsburgh, fourth largest producer, will shortly award a 48-inch blooming mill for its Aliquippa, Pa., works as the major item of a $4,000,000 improvement program.

Youngstown Sheet & Tube Co., fifth largest steelmaker, now has under way in the Youngstown district a continuous strip-sheet mill, with supplementary cold-rolling facilities, costing about $10,000,000.

The sixth largest interest—National Steel Corp.—is expected any day to announce contracts for a continuous strip-sheet mill at its Great Lakes division in Ecorse (Detroit) Mich., costing about $12,000,000.

Almost without exception, steelmakers are making estimates or taking bids on miscellaneous improvements, including retubing of boilers, rebuilding and enlargement of motors, and the purchase or modernization of equipment at coke ovens, open-hearth and blast furnaces, and rolling mills. In many cases great haste in getting this reconstruction under way is manifested.

Because actual bids on "key" items of its program may alter the picture somewhat, the Steel corporation is withholding a breakdown of its $47,000,000 program, but it is indicated that close to half this sum will be expended at Chicago.

Outstanding in the Chicago district improvements is expansion of the American Sheet & Tin Plate Co. works at Gary, Ind. For enlargement of the sheet department $11,700,000 is understood to have been allocated, and for additions to the tin mill $3,300,000, or a total of $15,000,000.

Hot Strip Mill Planned

Contracts are expected to be let shortly for seven buildings in which the new mills will be housed. One will be almost a half mile long to house a hot strip mill estimated to cost $6,000,000. Two continuous pickling installations costing $1,000,000 and a slab treating furnace costing $800,000 are nearing completion at Gary works of Sheet & Tin Plate.

Some improvements also are scheduled for the Gary and South Chicago works of the Illinois Steel Co. and the Chicago district plants of the American Steel & Wire Co., but details have not been announced.

In the Pittsburgh district the Carnegie Steel Co. is expected to be the chief beneficiary of Steel corporation modernization, estimates ranging from $12,000,000 to $15,000,000. Chief project is construction of a 116-inch continuous plate mill at the Homestead works to replace three existing plate mills. A new continuous hot strip mill at the Edgar Thomson works may cost close to $6,000,000.

Already the Carnegie company has under way a new continuous strip mill at its McDonald works (Youngstown), estimated to cost about $6,000,000. In event this expenditure is included in the $47,000,000 program, as is undoubtedly the case, the appropriation of about $20,000,000 at Chicago, $15,000,000 at Pittsburgh and $6,000,000 at McDonald leaves about $6,000,000 for other subsidiaries.

The Steel corporation's authorization of $47,000,000 for capital improvements corresponds with $7,650,000 spent in 1933 for manufacturing properties, about $7,000,000 in 1932 and about $59,000,000 in 1931. In 1930 gross expenditures totaled $144,000,000, but included the acquisition of the Atlas Portland Cement Co., Columbia Steel Corp., and Oil Well Supply Co. All of these figures are approximations. The statement for 1934 is not available.

Bethlehem's continuous strip-sheet mill at its Lackawanna plant, which will virtually supersede its present Seneca plant in the Buffalo district, will be of the 79-inch 4-high type. Later a 4-high cold strip mill will be built.

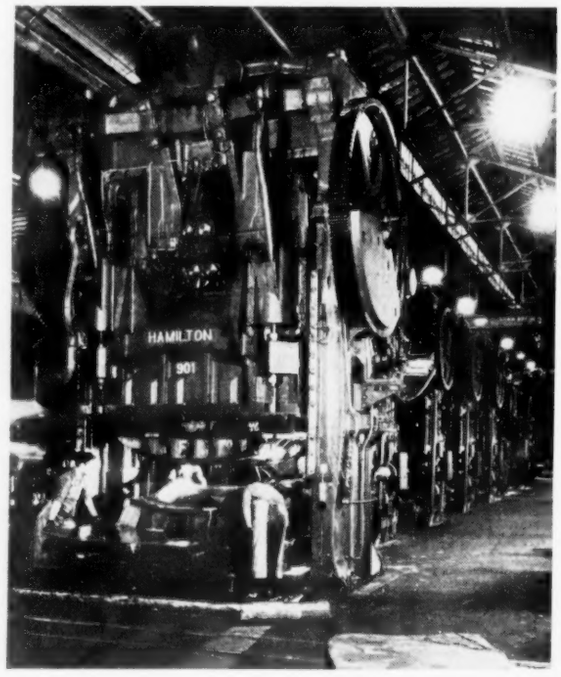
STEEL TO MOVE WEST?

Talk that the Steel corporation may move its headquarters to Pittsburgh, and that even the American Iron and Steel institute may evacuate New York, was revived last week. There also was talk of a reorganization of the Steel corporation on geographical lines. This results from the deduction that Washington might be appeased if steel moved farther away from Wall Street.

◆

WHEN STEEL MEETS STEEL in the central manufacturing division of Chrysler, in Detroit, fenders for Plymouth result. These giant presses are 15 to 35 feet high, weigh up to 400 tons, rest on foundations of steel and concrete up to 15 feet in depth. Pressure up to 2000 tons is exerted

◆



Bethlehem Pension Outlay $7,000,000

PENSION payments by Bethlehem Steel Corp., Bethlehem, Pa., to retired employes during the past 12 years have totaled $6,754,721, and more than $800,000 was paid out during the past year, according to the annual summary of employes representation activities contained in the current *Bethlehem Review*.

The employes' relief plan, in operation nearly nine years, disbursed during the year $934,828 in sickness and death benefits to more than 6100 participants or their beneficiaries.

In the Bethlehem organization, the pension, relief and other activities are all developed through the employes' representation plan in each plant, this form of relationship having been in effect in Bethlehem steel activities the past 16 years. Referring to the current interest and progress in collective barganing, the *Bethlehem Review* comments:

During the past year the employes' representation plans have continued to serve as effective agencies for collective bargaining. Not only have the representatives elected under these plans guided the various beneficial plans described above but they have also handled 814 cases of record concerning hours, wages and working conditions of their fellow employees.

Experience Most Active Year

Many more cases which were not of record were handled by the employes' representatives satisfactorily to the employe, without need for formal action.

The plans in the various plants of Bethlehem which have been in successful operation for some time and in some cases for more than 16 years, have had perhaps their most active period during the past year.

During the past year successful performance of the employes' representatives' duties has called upon them to devote a considerably increased time to representation activities. Hours had to be adjusted, wage changes discussed and work schedules rearranged. Many deserving employes have needed assistance due to the burdens placed on them during the depression. Credits have had to be extended, rent tangles straightened out, tax problems adjusted, etc.

The representatives through their daily contact with their fellow employes have been able to present their needs and views to the management with a first-hand knowledge and without delay. The management has invited the utmost frankness on the part of the representatives in the handling of these matters because it realizes that this is the only way to have a smooth and harmonious relationship.

As the elected representatives have brought up for adjustment the various problems of their constituents the management then has made every effort to effect settlement fairly and promptly. After 16 years of working together under the plan the management realizes that to allow complaints to fester and grow only breeds contention and strife.

All requests and recommendations have thorough consideration, and it is a tribute to the efficiency of the employes' representatives and to the fairness of the management that nearly 80 per cent of cases in 1934 have been settled favorably to the employe.

See Little Change For Steel Code

PRESIDENT ROOSEVELT'S message to congress Feb. 20 and its interpretation by Donald R. Richberg, his co-ordinator, lead to the impression that the steel code will be practically unchanged, both in regard to price filing and basing points, in the proposed 2-year extension of NRA.

Discussing the steel code, Mr. Richberg said that "the filing of prices does not necessarily mean price fixing" and that "the steel basing point system is not price fixing."

He referred also to the supervisory NRA authority on code authorities and he said that he is a member of the steel code authority and that he had not had any supervisory functions on that authority and has had no power to do anything. However, he stated that some supervisory powers have now been put into the steel code.

Still discussing the steel situation and what the codes have done, he stated that prior to the enforcement of the code there was rebating, drawbacks and similar practices, but since the advent of the code there has been nothing of the kind. He took special occasion to declare that "I hold no brief for the steel industry."

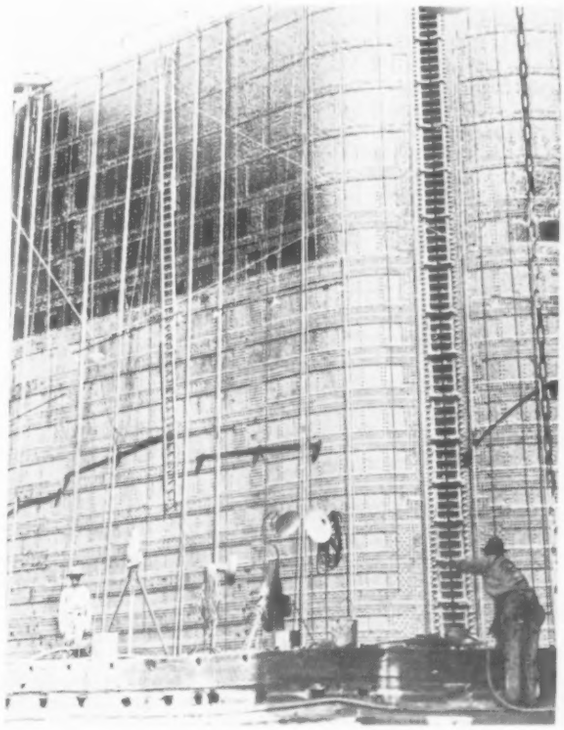
In urging extension of NRA for two years after June 16, the President in his message to congress, said just about what was expected of him. However, certain phrases he used lead to unending interpretations by government officials, including Donald Richberg, as well as members of congress and economists.

Wants Power Assured

The President stated positively that the government should be allowed to impose codes on industry where industry refuses to get together, and while this is in the present law, no code has ever been imposed because the recovery board and General Johnson before the board never thought that codes could be enforced under the law. The President evidently wants further power in this direction. He also wants more stringent enforcement of the antitrust laws.

One of the omissions in the message is whether NRA shall be ruled by a board, as at present, or by an individual. Reports are to the effect that he deliberately left this out of his message because he wants NRA to be "flexible," whatever that means.

It is quite evident from the wording of the message that the President is "sold" on the principles of NRA.



Despite their constant immersion the steel gates of the Panama canal require occasional cleaning. At right is shown one of the gates of the west chamber of the Gatun locks being overhauled. Acme photo

"The fundamental purposes and principles of the Act," he states, "are sound. To abandon them is unthinkable. It would spell the return of industrial and labor chaos."

Dealing with the question of voluntary codes, he said that "voluntary submission of codes should be encouraged but at the same time, if an industry fails voluntarily to agree within itself, unquestioned power must rest in the government to establish in any event certain minimum standards of fair competition in commercial practices, and, especially, adequate standards in labor relations. For example, child labor must not be allowed to return; the fixing of minimum wages and maximum hours is practical and necessary."

On the labor question the President said: "The rights of employes freely to organize for the purpose of collective bargaining should be fully protected."

In this connection Mr. Richberg at a press conference stated that in his personal opinion, evidently shared by the administration, the present section 7a will work out alright. He stated that there would be no need of changing this section at all, unless it can be clarified. It was apparent that he did not believe that it could be.

Yes and No on Antitrust Laws

Dealing with the antitrust laws the President said in his message:

"The fundamental principles of the antitrust laws should be more adequately applied. Monopolies and private price fixing within industries must not be allowed nor condoned. 'No monopoly should be private.'

"But I submit that in the case of certain natural resources, such as coal, oil and gas, the people of the United States need government supervision over these resources devised for the purpose of eliminating their waste and of controlling their output and stabilizing employment in them, to the end that the public will be protected and that ruinous price cutting and inordinate profits will both be denied."

Senator Pat Harrison, of Mississippi, is chairman of the senate finance committee, which will draft the new law.

It is possible that there will be a three-ring NRA investigation. In the first place, drafting of the renewal legislation is in the hands of the senate finance committee. That means that members of the recovery board and others will be asked to testify.

There is also a resolution for the investigation of NRA, introduced by Senators Nye and McCarran, which has been favorably reported by the finance committee, and a further investigation has been practically undertaken by the senate judiciary subcommittee under the chairmanship of Senator King, of Utah. This has led to much confusion.

Structural Code

CONFERENCE were renewed in Washington last week on the proposed NRA structural steel code which has been pending since July owing to the fact labor is insisting that erection be put under the contractors code.

C. G. Conley, president, American Institute of Steel Construction, who has just returned from the west coast, and C. Edwin Michael, of the Virginia Bridge & Iron Co., Roanoke, Va., a director of the Institute, attended, representing the industry.

They conferred with W. P. Witherow, vice chairman of the NRA industrial advisory board, who has done so much for industry here, and D. M. Nelson, assistant to S. Clay Williams, chairman of the national recovery board.

Messrs. Conley and Michael have now been turned over to Major Campbell, an assistant deputy at NRA.

Merger

AN agreement between counsel for Republic Steel Corp. and Corrigan, McKinney Steel Co. and the department of justice on the latter's suit to halt the merger of the two companies led to postponement of the hearing for a temporary injunction in Cleveland, Feb. 19.

Instead, the case will be tried on its merits beginning March 18, and in the meantime the steel companies agree not to proceed further toward consummation of the merger. Defendants have until Feb. 28 to file their answer.

There was some speculation last week that fear of the government's attitude may have chilled recent discussions of a merger of the National Steel Corp., Pittsburgh, and the Inland Steel Co., Chicago, although the industry prefers to believe there were other and more important barriers.

Steel in the News

NATIONAL TUBE CO., Pittsburgh, has sold its Pennsylvania works, Second avenue, Pittsburgh, and its Republic department, Twenty-fourth street, South Side, Pittsburgh, to a combination of Pittsburgh dismantlers and scrap brokers comprised of United Iron & Metal Co., Charles Dreifus Co., and Jay Stephens Co.

The sale was consummated Feb. 19, and it is estimated that upward of 5000 tons of scrap will be realized. The building at the Pennsylvania works alone covers over 17 acres. The past few years National Tube has moved considerable equipment from the two works to its McKeesport, Pa., division, and from time to time has disposed of numerous tonnages of scrap located at the two plants.

The Pennsylvania department formerly produced lap-weld black pipe from 2 to 12-inch diameter and with six lap-weld furnaces had a rated annual capacity of some 300,000 tons.

Neither of the works has been operated in many years.

Additional news this week on pages 73 and 74.

Institute

A NEW set of commercial resolutions, an amendment to another, and a revision of a set of regulations have been put into effect by the American Iron and Steel institute.

The new resolutions, known as No. A38, pertain to arrangements for the storage, handling or delivery of products or other property owned by code members and define certain violations.

The resolution amendment is to resolutions No. A33. As a result of this amendment, the original, which had to do with the reporting by code members of arrangements for the leasing of space for their products, have been extended to include the reporting of arrangements for the handling or delivery of their products under certain given conditions.

The regulations amendment applies to paragraph J4, regulations No. 4, and pertains to reduction in the delivery of products shipped in whole or in part by water transportation for delivery through a Pacific coast port, not a basing point, for ultimate destination elsewhere. In the original, the ultimate point of delivery was

(Please turn to Page 73)

Production

STEELMAKING receded still further last week, easing 3 points to 50 per cent, and surrendering all of the improvement since the third week of January. A sharp curtailment in operations in the Chicago district contributed mainly to this decline. Unless something unexpected develops, the rate may taper off slightly this week. Details for various districts follow:

Pittsburgh—Off 2 points to 37 per cent, and this rate may hold for this week. Steelmakers have reverted to slower blast on several steelworks blast furnaces, but continue to actively list 24 out of 60. Individually, Carnegie has 9 on, National Tube 2, Jones & Laughlin 7, Bethlehem 4,

and Pittsburgh Crucible Steel and Pittsburgh Steel each 1.

Wheeling—Off 2 points to 85 per cent, with 32 out of 37 open-hearth furnaces on schedule. Some of the open hearths, however, are on more infrequent heats.

Cleveland-Lorain—Up 2 points to 79 per cent last week, Otis Steel Co. lighting its eighth unit which has been down several weeks for repairs. Corrigan-McKinney continued with 12 and National Tube Co., Lorain, with 11. These schedules will hold this week.

Chicago—Dropped 10 points to 53 per cent last week, as a result of the sharp curtailment by one interest. This was caused by a lifting of pressure for delivery to the automotive industry and schedules of other mills

Steelmaking Operations

Percentage of Open-Hearth Ingot Capacity Engaged in 10 Leading Districts

	Week ended Feb. 23	Change	Same week 1934	Same week 1933
Pittsburgh	37	— 2	28	15
Chicago	53	—10	44	18
Eastern Pa.	31	None	29½	11
Youngstown	58	— 2	54	17
Wheeling	85	— 2	69	†
Cleveland	79	+ 2	77	31
Buffalo	45	None	47	19
Birmingham	55½	None	52	17½
New England	63	None	79	†
Detroit	100	None	79	†
Weighted av.	50	— 3	47	17

†Not reported in 1933.

were steady at the year's peak. Some recovery in the operating rate is anticipated within the next several weeks. Blast furnace operations are unchanged, with 14 of 36 steelworks stacks active.

Youngstown—Off 2 points to 58 per cent; starting this week at 56.

Districts holding steady last week were: Detroit at 100 per cent, eastern Pennsylvania at 31, Buffalo at 45, New England at 63, Birmingham at 55½.

SHEET ACTIVITY GAINS

Sheet steel sales, production and shipments increased substantially in January, according to the National Association of Flat Rolled Steel Manufacturers, Pittsburgh. Sales averaged 10,381 net tons daily; production 7603 tons; shipments 6642 tons. The figures for December were 6230, 5153 and 4566 tons, respectively. Totals for January were: Sales, 321,831; production, 235,714 tons; shipments, 205,915 tons. Total sheet capacity in the country for January was approximately 550,000 tons, and the capacity on which the association's figures are based was 319,000 tons.

Light Steel Leads In 1934 Output

STEEL production, higher in 1934 than in 1933, reflected the increasing importance of lighter steel products, according to an analysis of the industry's production records by the American Iron and Steel institute.

Production for sale of all code steel products by members of the code in 1934 totaled 21,174,628 gross tons, up 10 per cent from the 1933 total of 19,243,791 gross tons. More than three-fifths of this increase came from expanding demand for sheets, strip, wire and other light products, for which production aggregated 9,018,000 gross tons in 1934, approximately 15 per cent higher than the 7,836,000 gross tons produced in 1933.

Largest consumers in 1934 were automobile, railroad, building materials and equipment, and container industries, in that order.

Steel Production by Code Members in 1934

		Gross Tons			Shipments	
Steel Products	Number of companies	Annual Capacity	Production For Sale Total	Per Cent of capacity	Export	To members of Iron and Steel Code for conversion into Code products
Ingots, blooms, billets, slabs, sheet bars, etc.	41		3,082,664		22,244	2,765,431
Heavy structural shapes	14	5,440,520	1,140,267	21.0	35,862	
Steel piling	5	270,000	103,354	38.3	3,472	
Plates—Sheared and Univ.	28	6,224,955	1,261,406	20.3	35,315	3,306
Skelp	10		352,461		54,764	224,822
Rails—Stand. (over 60 lbs.)	6	4,850,000	905,892	18.7	22,694	
Light (60 lbs. and under)	9	805,820	67,813	8.4	12,216	
All other (incl. girder, guard, etc.)	3	140,000	30,446	21.7	7,166	
Splice bar and tie plates	20	1,662,571	312,597	18.8	6,448	
Bars—Merchant	53		1,903,701		35,961	191,364
Concrete reinforcing	39		469,178		8,468	
Cold finished—Carbon	19		330,640		1,618	
Alloy—Hot rolled	17		401,740		3,029	33,187
Cold finished	14		38,224		96	
Hoops and baling bands	6		48,573		1,403	
Total Bars	76	13,101,707	3,192,056	24.4	50,575	224,551
Tube rounds	8		44,707		1,843	41,509
Tool steel bars (rolled and forged)	18	107,850	24,458	22.7	83	
Pipe and tube—B. W.	16	1,913,928	463,770	24.2	35,661	
L. W.	10	1,726,734	270,239	15.7	21,865	
Electric weld	4	819,571	56,275	6.9	179	
Seamless	15	2,520,978	658,117	26.1	54,639	
Conduit	6	142,350	33,363	23.4	496	
Mechanical tubing	5	212,050	56,680	26.7	3,132	
Wire rods	20		363,818		18,772	166,744
Wire—Drawn	49	1,848,107	718,594	38.9	43,165	13,421
Nails and staples	26	1,169,967	292,949	25.0	17,712	
Barb., fence, bale ties, fence posts, etc.	30	1,562,789	338,290	21.6	37,877	
Black plate	16	362,879	284,168	78.3	8,527	122,461
Tin plate	17	2,666,763	1,510,830	56.7	205,751	
Sheets—Hot rolled	25		785,029		16,153	45,003
Hot rolled annealed	25		989,589		43,634	2,741
Galvanized	19		678,774		71,113	
Cold rolled	21		970,793		31,211	
All other	16		291,290		7,649	
Total Sheets	37	7,898,722	3,715,475	47.0	169,760	47,744
Strip—Hot rolled	35	3,458,752	1,323,086	38.3	19,806	140,796
Cold rolled	41	996,097	391,612	39.3	5,690	
Wheels (car, rolled steel)	6	400,284	78,394	19.6	911	
Axles	10	441,900	23,968	5.4	230	
Track spikes	13	350,260	67,613	19.3	697	
All other	7	21,707	9,266	42.7	2,772	
Total Code steel products	190		21,174,628		900,354	3,750,785
Estimated total steel finishing capacity based on yield from ingots of 69.4%		46,841,000		37.2		
Iron Products						
Pig iron, ferromanganese and spiegel	36		3,014,007		3,327	827,129
Ingot molds	6		180,802		3,496	
Plates	3	32,260	1,745	5.4	1	
Skelp	2		2,505		747	1,759
Bars	14	241,919	42,416	17.5	115	1,814
Splice bars and tie plates	1	50,000	8,849	17.7		
Pipe and tubes	5	231,153	40,077	17.3	310	
Sheets	2	18,000	8,124	45.1	1	
All other	4	51,800	10,119	19.5		
Total iron products	21	567,172	113,835	20.1	1,174	3,573

DETROIT

NOTWITHSTANDING that automobile production departments are completing the best February since 1929 and sales managers are maintaining strong backlogs, they are not totally eclipsing engineering staffs.

Plymouth, subject of many rumors, is understood to be preparing to bring out, probably in April, one or two series to supplement the present line and make it competitive with Ford and Chevrolet, which the present jobs frankly are not.

In 1934, it will be recalled, this maker offered 12 models in four series—the deluxe, special, standard and the six. All were powered by the same engine, the difference being in wheelbase, body refinements, mechanical accessories and, of course, cost.

MOST SALES IN DELUXE LINE

At the January shows four deluxe and two Plymouth six models were shown, and the latter two are now in process of being converted into deluxe types. Whereas Chevrolet prices start at $465 for the standard coupe and Ford at $495, Plymouth's lowest price under the current setup is $565.

Although it is expected that close to 90 per cent of Plymouth's business this year as last will be in the de luxe range, it is logical to expect that some models will be added to compete in the bottom level of the low price market.

Possibly in anticipation of this change, Plymouth has held up releases for some materials, including fabrics but not steel. After operating two shifts six days a week, the schedule has been eased off to five and one half days and some of the additional labor required by provisions of the automobile code has been laid off.

Between Jan. 1 and Feb. 16 retail deliveries of Plymouth dealers totaled 39,498 units, against only 18,229 a year ago. In the same period, factory production was 110,000 units, indicating that stocks of about 12,000 dealers aggregate 70,000 units, which is not excessive. Dealer orders approximate 140,000 units, providing a 14-week backlog at the present rate and equal to the entire output of 1932.

OTHER NEW MODELS PROPOSED

Cadillac and LaSalle, which have done some buying of machine tools, are expected to make a few minor changes shortly, but there will not be a noteworthy revision of these lines prior to the 1936 models, to be introduced next summer. At Buick there are first signs of a stirring preliminary to the 1935 series, also scheduled for summer announcement.

Nash is having dies made for its new LaFayette series, which will be priced even lower than the present models, which start at $585 for the coupe. As nearly as Nash engineers can do it within the limitations of cost, the new LaFayettes are expected to duplicate present Nash body lines.

For a number of years, Cadillac has had a lower price running mate in LaSalle. Packard now has a companion car in its $1000 series—actually, $1200 to $1300 delivered. The question is, will Ford now be induced to bring out the lower price Lincoln which undeniably has been on the boards for several years? Detroit believes so.

Ford's basic instinct is to go down in price rather than invade the middle class field. At the same time, the Lincoln plant has been a financial deadweight and the present boiling market for automobiles, coupled with the prospect of some degree of inflation, might result in the middle price field coming back.

At present, Lincoln production is about 10 a day, five days a week. Ford engineers, riding the crest of a wave that is washing up almost 5500 Fords daily, find it difficult to speak of such a low rate dispassionately. In fact, every day between 7 a.m. and 1 p.m. as many Fords roll off the assembly lines as all the Lincolns made in 1934.

It is no secret that plans for a medium price Lincoln, presumably a V-12, have been available for several years. Experimental work also has been done on a V-8 for this price class. There also has been some speculation in Detroit whether a name other than Lincoln would be used. However, the entire matter is a personal decision by Mr. Ford, and nothing is more unpredictable.

WATCH PACKARD RECEPTION

Certainly Detroit will watch the Packard experiment with its meduim price job with great interest. Since Packard was the only maker, other than DeSoto with its new airflow, to slump in sales last year when the industry as a whole was coming back strongly, obviously it will mean much to Packard to have its new series go over.

Packard's overhead is relatively lower than most ventures of the kind because it already has the plant, but several millions were spent for special machinery, some of which is streamlined and most modernistic. Designers evidently were put to it to retain the conventional Packard radiator line in a streamline dress.

Naturally Packard is not discussing such a matter publicly, but there is some speculation in Detroit that

at the present price—about $1000 f.o.b. factory—about 40,000 of these new models should be marketed this year to make a satisfactory financial showing. This is about six times Packard's sales in 1934 and three times the 1933 volume. Packard's name is still one of the best, and Detroit believes that provided general business is good, it can be done. As a matter of fact, Packard's schedule on the new line is 4000 for March and 4500 monthly thereafter—an ambitious program.

Incidentally, the experience of LaSalle in the medium price field has not been a happy one thus far. Last year, when the price was cut an average of $750 per model sales went up only 1400—from 3709 in 1933 to 5182 in 1934. In gross volume, this reduction thus cost LaSalle about $500,000. It has this satisfaction however—far more cars are modeled after the 1934 LaSalle than after the 1934 Chrysler airflows.

Hudson-Terraplane is another manufacturer to report a genuinely enormous bulge in demand. From Jan. 1 to Feb. 15 its sales totaled 22,094 jobs, almost triple the 7413 in the comparable period last year. Incidentally, from the manner in which the department of justice is equipping itself with the big Hudson, it is suicide for any public enemy to ride around in anything slower. Continuing its quest for records, Hudson-Terraplane hung up several new ones last week at Daytona Beach with Sir Malcolm Campbell at the wheel.

Chevrolet assemblies have not yet quite reached 3000 a day, on a six-day basis, but its foundry last week was pouring 270 engines an hour 18 hours a day, also on a six-day week, which is 4860 engines daily. Dealers are being stocked with the new master models. It looks like Ford has a big lead, but last year Chevrolet staked him to several months and still overtook him, so Detroit does not regard the present Ford advantage as conclusive.

FORD ECLIPSING OLD MARKS

Ford by the way, is now probably at an all time peak in point of production activity. The high water mark on Model A was about 8300 daily, in 1930, and on Model T about 9500 daily, in 1924 or 1925. Today's Ford has twice as many cylinders as either of the two older jobs, and especially over Model T is the number of parts and machining operations greater.

Hence it is figured that at about 5500 current models daily Ford is equalling, in point of operations, his previous records. And it is being done with about 65,000 workmen, against a peak of about 100,000 previously.

Incidentally, the five-day week is "out" at Fordson, and so also is the third shift due to a personal prejudice of Mr. Ford against it. There are two shifts, each of eight hours, and manufacturing generally except in the continuous processes is held to the period 7 a.m. to 11 p.m. six days a week.

Certainly the consumption of electric power at the Dearborn plant is touching the previous peak, which was 1929. Electric welding has been developed on a large scale, heat-treating furnaces have been installed, electric furnaces are operated both in the steelworks and the foundry, and the result is a monthly power load of 61,000,000 kilowatt hours. By comparison, the monthly consumption of a one-family house probably averages 100 kilowatt hours. The present V-8 requires three times the electric power to make that old Model T did.

NOT one of the fiery words that have been uttered by William Green, president of the American Federation of Labor, and other labor leaders has escaped the attention of automobile executives, but they are not jittery because they are confident they have built up the best defense possible under the circumstances.

Intensive work has been done, especially by General Motors, on foremen. They are the wheel-horses of the production force, they must interpret the management's policies to the men, they are the vital link between the management and employes, they are expected to watch for any irritations and correct them before they are magnified into grievances.

Whether or not the automotive industry faces serious labor trouble this spring appears to hinge on these issues: (1) What the American Federation of Labor will do as a matter of policy and money; (2) the extent of its organization discipline in automobile ranks and the effectiveness of its leaders; and (3) to what extent areas of discontent, which provide a fertile field for agitators, remain.

SEE ONLY MINOR FLAREUPS

After giving due weight the fact that Mr. Green and his leadership of the federation are on the spot and that there is enormous pressure for aggressiveness and action, automobile executives still point to the fact it takes money to organize any industry. It also takes leaders who can rouse labor from self-interest in its individual problem to a fervor for labor as a mass.

Anything may happen, of course, but the best judgement at present is that trouble will be restricted to a few areas or departments which organized labor believes to be bottlenecks. From the standpoint of cities, Cleveland and Toledo are the worst. It is noteworthy that General Motors decided to locate its new diesel locomotive building plant in Chicago instead of at Cleveland, where the diesels are made, because of the bad labor situation in Cleveland.

Fisher Body, a General Motors subsidiary, also makes the new steel turret tops at Pontiac as well as at Cleveland, hence the threatened difficulty at the Cleveland plant is not so crucial. More than is generally known, there has been a diversification of manufacturing operations to avoid the possibility of labor putting its finger on any one spot and tying up the industry.

With the statement of policy by Alfred P. Sloan Jr., its president, as a text, General Motors is believed to have done an outstanding job in labor relations the past year:

The management of General Motors holds that there is no real conflict of interests between employers and employes. Such apparent conflicts as may arise may usually, if not indeed always, be traceable to a lack of mutual understanding or to a shortsighted viewpoint on the one side or the other.

OLDS guessed that light colors would be in demand, but its black jobs with red striping have proved so attractive it is weeks behind in making deliveries. . . . Four Wheel Drive Co., Clintonville, Wis., has brought out a "camel back" truck with an all-steel cab set over the engine. . . . Last week's production of 82,481 units breaks down into 23,156 for General Motors, 32,555 for Ford, and 18,175 for Chrysler.

Automobile Production

Passenger Cars and Trucks
U. S. Only
By Department of Commerce

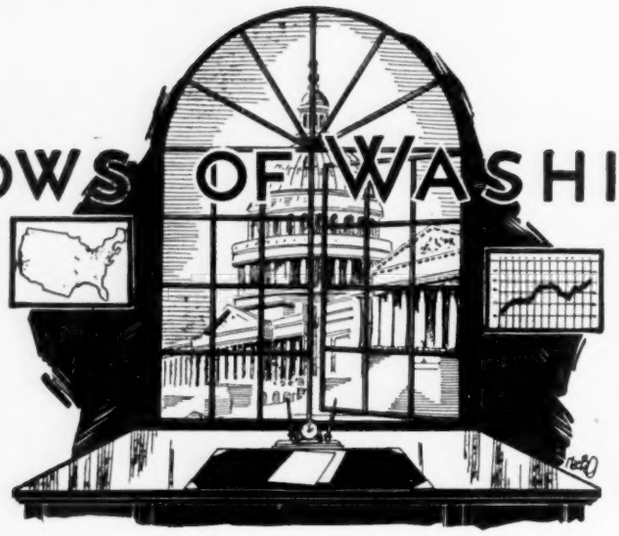
	1933	1934	1935
Jan.	128,825	156,907	300,000*
Feb.	105,447	231,707	.....
Mar.	115,272	331,263	.....
Apr.	176,432	354,745	.....
May	214,411	331,652	.....
June	249,727	308,065	.....
July	229,357	266,576	.....
Aug.	232,855	234,810	.....
Sept.	191,800	168,171	.....
Oct.	134,683	132,491	.....
Nov.	60,683	78,465	.....
Dec.	80,656	183,187	.....
Year	1,920,057	2,778,739	.....

*Estimated.

Estimated by *Cram's Reports*

Week ended:	
Feb. 9	78,453
Feb. 16	82,119
Feb. 23	82,481

WINDOWS OF WASHINGTON



WASHINGTON

ORGANIZED labor's gloating following the 44 to 43 defeat for the President on the "prevailing wage" clause of the $4,880,000,000 work relief bill recalls the story of the flea who followed the elephant across the bridge and, perceiving the vibration, exclaimed, "Gosh, but I am powerful."

Actually, so many factors entered into the vote that it is impossible to appraise their strength precisely. The Republican vote probably was a mixture of outright opposition to the President and an opportunity to ridicule and embarrass his program; the Democratic vote was partially the strength of labor and the fear of southern senators of the consequences upon negro labor in the South.

LABOR SCENTS VICTORY

But superficially, it looks as though organized labor has licked the President and it makes sweet revenge for the steam rollering of its objection to continuation of the automobile code and the Wolman automobile labor board.

Certainly it emboldened William Green, president of the federation, sufficiently to state Friday that he will throw his entire strength behind the Wagner labor disputes bill. Said Mr. Green: "Labor will appeal to congress to enact the Wagner measure at the earliest possible date. It will call upon its friends to actively interest themselves in its behalf."

Thrown into the senatorial hopper last week, the Wagner bill on the surface appears even more obnoxious than its predecessor last session. It virtually outlaws so-called company unions, it sets up the national labor relations board on substantially the same independent basis as the federal trade commission, and specifies majority rule.

Among other things, the Wagner bill illustrates the remarkable inconsistencies now existing in Washington, both as regards issues and personalities, and once more it puts the President between Scylla and Charybdis.

Assiduously attempting to woo business and stimulate the recovery he now realizes he so sorely needs, the President is understood not to be so strong for the principles of the Wagner bill as he was a year ago. Yet to side with business on this issue is to oppose two close personal friends — Senator Wagner and Secretary of Labor Perkins.

Feeling its oats because of its self-heralded victory on the matter of prevailing wages in work relief, which would double the cost or halve the number of persons benefited, organized labor has the bit in its mouth. It expects to put congress on the spot on both the Wagner and the 30-hour week bills. It is fulminating against the automobile industry. The hearings on the Wagner bill may be the most exciting at this session of congress.

FOR the present, Michael F. Tighe, 76-year old leader of the Amalgamated association of Iron Steel and Tin Workers, appears safely in the saddle. He has survived, temporarily at least, the revolt against him.

Last week Mr. Tighe revoked the charters of 13 Amalgamated lodges, including such timely-designated ones as New Deal, Cross Roads of America, Recovery, and Blue Eagle. Former members of these 13 lodges are invited to purge themselves of the rebels headed by William J. Spang and to organize new sub-lodges.

Meanwhile, the roaming offshoot of the Amalgamated, headed by Mr. Spang, continued to find recourse for its troubles last week in meetings.

Termed "roaming"—because many communities will not grant them meeting hall permits—the rank-and-filers of the Amalgamated on Feb. 17 hied to Ambridge, Pa., a mill town some 30 miles from Pittsburgh.

First off, some 400 attending voted to exclude newspapermen. But this expulsion only whetted investigators' appetites and after the meeting closed they learned that only 60 delegates from 13 exiled Amalgamated lodges attended the meeting. The rest were "visitors."

MORE NOISE, MORE MEETINGS

They also learned that a resolution denouncing President Tighe for outlawing these 13 lodges was adopted and telegrams concerning the action were dispatched to President Roosevelt and Secretary of Labor Perkins. And it ultimately was no secret that plans were made for a similar meeting at Braddock, Pa., March 3, and at Weirton, W. Va., March 10. Strangely, both A. F. of L.'s President Green and Mr. Tighe were to be invited.

Meanwhile, last week it took the Weirton Steel Co. management to show what becomes of a worker who takes the too-frequent union meetings so seriously. "Too many leaves of absence" was the reason given for the dismissal of Mel Moore from the sheet mill at Weirton, where he had been one of the mill's highest paid rollers. Moore has been prominent among the rank-and-filers' off-shoot from the official Amalgamated.

BLACKWELL SMITH, acting chief counsel of NRA, asked regarding the steel basing point report to be sent to the President by that body stated that "there is co-ordination to be done that hasn't yet been done." He refused to discuss the report further than that.

One of the authors of the basing point report as originally drafted for the White House, has now been recalled to Washington, from his professorship and he is reported to be working on some revisions of the

original together with experts of the research and planning division of NRA. Some corrections in the text are also being made, it is stated.

It is said that there is likelihood of changes in the NRA position on the basing point, but nothing vital. It is believed the organization still will favor the basing point as a matter of principle.

There is also talk that NRA will make an effort to hold another conference with officials of the federal trade commission. It is admitted, however, that such a conference could not lead to any basic change in either report. It would be merely a getting together on some minor features.

OFFICIAL OPINIONS AT ODDS

Admittedly there is a difference of opinion among officials of NRA. When Judge Ewin L. Davis, chairman of the trade commission, had his attention called last week to a possible conference, he stated that he had not been asked for one. He called attention to the fact that one such conference already had been held; that he would not refuse a further conference, although he saw no use in it. He implied that if the members of NRA couldn't reach an agreement among themselves, what chance would the commission have to reach any kind of agreement with them?

The greatest secrecy has been maintained on the whole question of the steel basing point. No statement ever has been forthcoming from the White House on the question, other than to admit that the trade commission report was received. There is every indication that neither report will ever be made public unless the two reports can be made to harmonize. This is not expected even by the most optimistic.

THE feeling that Washington is critical of big business and highly concentrated units may have prompted the American Iron and Steel institute last week to disclose the wide scope and diversification of that industry.

Products by the steel code are manufactured in 433 plants with an aggregate investment of $5,000,000,000, employing over 400,000 persons, having payrolls over $455,000,000 annual and with annual tax payments to federal, state and local governments estimated at $80,000,000.

Pennsylvania has 130 plants making steel code products. Ohio 87. Twenty-nine states have one or more plants.

SPECULATION is rife as to when members of the national recovery board will resign and give place to another board.

In this connection D. M. Nelson, vice president, Sears, Roebuck & Co., and assistant to S. Clay Williams, chairman of the recovery board, expects to leave NRA the middle of March, unless some unexpected developments come up in the meantime—such as an attack on the board from congress.

WILL STAY FOR HEARINGS

The best information available is that the members of the board will stay on the job until after congress has held its hearings regarding the extension of NRA. They will be wanted at the hearings. Also there is a possibility in connection with the King investigation that members of the board may come under fire, in which case they will most certainly stay to face the music.

It is believed that it will be necessary for Nelson to get back to his own job before General Wood comes to Washington in connection with his advisory work on the $4,800,000,000 allotment. However, when he first came here he set a limit on his time and that is more than up.

Domestic manganese producers are very active here these days in conferences with members of congress in connection with the reduction of the tariff on manganese ore from Brazil under the recent treaty, reducing the tariff by 50 per cent.

The group will either correspond direct with the secretary of state or else a bill will be introduced in congress asking for action, possibly on the tariff treaty already enacted or with future treaties.

SENATOR Shipstead of Minnesota has introduced a senate bill to provide for the carrying out of an award by the national war labor board of April 11, 1919, in favor of certain employes of the Minneapolis Steel & Machinery Co., Minneapolis; St. Paul Foundry Co. and American Hoist & Derrick Co., St. Paul; and Twin City Forge & Foundry Co., Stillwater, Minn. An appropriation of $1,200,000 is provided for in the bill for the awards. It has been referred to the senate committee on claims.

Similar bills have been introduced in the house and senate to stabilize the coal mining industry, by Representative David J. Lewis of Maryland and Senator Carl Hayden of Arizona respectively.

The bill legalizes the rights of the employes to form protective unions, bargain collectively, to have checkweighmen, among other things, and provides that in determining the minimum prices "reasonable living wages for the workers" shall be included.

The measure creates three main functioning units. They are (1) division of the United States into 27 coal districts, (2) formation of a coal operators national council and (3) creation of a federal coal court.

The power of the federal government under the bill is principally that of arbitration and supervision. Its function is more judicial than executive.

INTERESTING because of the apparent impasse in negotiations between United States and U. S. S. R. is the unofficial information received here to the effect that the Soviet Union has placed orders recently for some $5,000,000 worth of machinery and equipment in England. About half of this amount, it is reported, is for railway wheels, axles and tires requiring about 30,000 tons of steel.

Another reported order is for machinery and equipment for Soviet paper factories. It is the first time that such equipment has been ordered in England by the Soviet. Another order is for 25,000 tons of various kinds of steel. The British nonferrous metals industry also received orders for $1,500,000 worth of materials. All of these orders were placed on a cash basis.

Died:

MAX R. TREMBOUR, 55, director of research and superintendent of electric furnaces for the Jessop Steel Co., Washington, Pa., in Washington hospital, Feb. 15. He was born in Germany and, after graduation from the University of Heidelberg, was engaged in business in Greece and Germany. He came to this country just prior to the war and was associated successively with the Ludlum Steel Co., Central Alloy Steel Co., Colonial Steel Co., and finally the Jessop company. He was well known for his pioneer work in introducing the electric furnace in this country, his work on high-carbon high-chrome and other special alloy steels, and lately for his work in the field of composite steels.

□ □ □

Wilson T. Ramsey, 56, general foreman at the Sharon Pa., works of Westinghouse Electric & Mfg. Co., in Sharon recently.

□ □ □

George H. Grotenrath, 55 vice president, American Machinery & Construction Co., Milwaukee, Feb. 5, after several months' illness.

□ □ □

Leo A. Mahoney, 35, for the past ten years chief engineer of the Edwards Iron Works, South Bend, Ind., in that city recently.

□ □ □

John F. Kent, 69, at one time vice president and general manager of the American Cast Iron Pipe Co., Birmingham Ala., in that city, Feb. 15. He was also former plant mana-

ger at the Ensley plant of Tennessee Coal, Iron & Railroad Co. Before his Birmingham associations, he was connected with the Jones & Laughlin Steel Corp., Pittsburgh, Lorain Steel Co., Johnstown, Pa., and Dominion Iron & Steel Co., Sydney N. S.

□ □ □

Samuel E. Rauh, 81, for 30 years a director of the Kokomo Steel & Wire Co. and Continental Steel Corp., Kokomo, Ind., in Indianapolis recently.

□ □ □

Doyle A. Stout, 53, chief engineer of mines and quarries of the Colorado Fuel & Iron Co., in Pueblo, Colo., Feb. 10. He had been with the company 23 years.

□ □ □

M. F. Ryan, 61, vice president and western representative of the Pittsburgh Spring & Steel Co., Pittsburgh, in Chicago, Feb. 17. He had been identified with the company for 32 years.

□ □ □

James K. Mitchell, 81, prominent banker in Washington, Pa., and early in his business career associated with John F. Budke in organizing the Canonsburg Rolling Mill Co. in 1882, in Washington, Pa., Feb. 18.

□ □ □

Clement C. Smith, 69, long prominent in American industry, at his winter home in Pasadena, Calif., Feb. 14. Born in Cleveland, he went to Milwaukee in 1890, later became associated with the Falk Corp., and then engaged in a notable career in building and rebuilding public utility property throughout Wisconsin and the middle west. During the World war he acquired the Baltimore Shipbuilding & Dry Dock Co. He was chairman of the board of the Heil Co., Milwaukee.

□ □ □

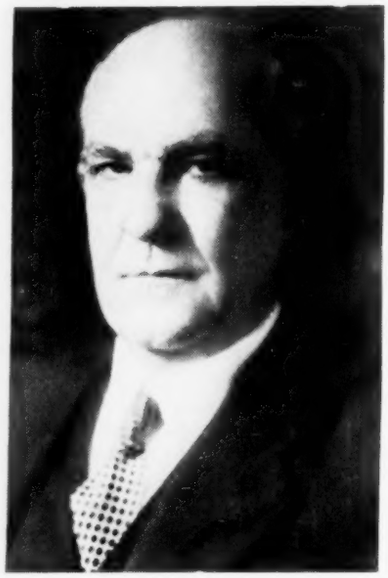
James H. Kessack, office manager of the sales department, Bethlehem Steel Co., in Bethlehem, Pa., Feb. 15. Born in Harrisburg, Pa., he first became associated with the steel industry in 1908 in the accounting department of the Pennsylvania Steel Co., Steelton, Pa. He remained in the accounting department when the Pennsylvania company was merged with Bethlehem, and about 1918 was made a special assistant to the comptroller. In 1930 he was transferred to the sales department as office manager.

DIESELS STAR AT SHOW

Caterpillar Tractor Co. staged at Peoria, Ill., Jan. 8-26, an exhibition and machinery show, in which over 50 manufacturers co-operated and attracted 25,000 visitors. Diesel engine production of the Caterpillar company was revealed as having increased from 1056 horsepower in 1931 to 237,314 in 1934.

Industrial Men In Day's News

Dr. H. A. Buehler, President-Elect, American Institute of Mining and Metallurgical Engineers



An elected life-member of the society for over 20 years, he is a nationally known geologist.

For many years he has been state geologist for Missouri, and now assists administration of relief funds.

Author of an impressive array of geological books, he holds a high position among his co-workers.

DR. H. A. BUEHLER, newly-elected president of the American Institute of Mining and Metallurgical Engineers (see p. 46), is state geologist and director of the Missouri bureau of geology and mines, Rolla, Mo. A native of Wisconsin, he has been engaged in geological work since his graduation from the University of Wisconsin.

For six years after graduation he served as assistant state geologist of Missouri and for the next two years as geologist for the Federal Lead Co. He then was recalled by the state of Missouri to serve as state geologist and director of its bureau, positions he has held ever since. During the last few years his official duties have included administration of a large part of state relief funds.

In addition to his official work, he has given much attention to consulting practice and has made many contributions to geological literature, especially in the field of ore genesis. He is author or co-author of *Quarrying Industry of Missouri*, *Geology of Granby Area*, *Lime and Cement Resources of Missouri*, *Oxidation of Sulphide* and others.

Dr. Buehler has been the recipient of many honors, including a doctor of science degree from the University of Missouri. He was elected to a life membership in the American Institute of Mining and Metallurgical Engineers over a decade ago. He is an honorary member of Sigma Xi and Tau Beta Pi, a member of the St. Louis Academy of Science, the Society of Economic Geologists, American Society of Petroleum Geologists, and the Geographical Society of America.

□ □ □

Fred D. Rankins has been appointed sales manager of the newly-created industrial division of Fostoria Pressed Steel Corp., Fostoria, O. For several years he has been district manager for the company at Boston.

□ □ □

A. W. Lauder has been appointed vice president and general manager of the Aurora Metal Co., Aurora, Ill. He formerly was president of the Trindl Corp., and prior to that was connected with Lyon Metal Products Co. for many years.

□ □ □

Arthur J. Tuscany, for the past seven years associated with the national organization of the gray iron foundry industry, has resigned as executive secretary of the Gray Iron Founders' Society Inc., Cleveland, and has established headquarters in the Penton building, Cleveland, to provide active and advisory service to trade associations and code authorities. Recently he was named executive secretary of the Foundry Equipment Manufacturers' association and of the code authority of the foundry equipment industry.

□ □ □

Lewis A. Dibble, president of the Risdon Mfg. Co., has been elected president of the Eastern Malleable Iron Co., Naugatuck, Conn. Charles L. Berger, associated with the latter company for 48 years, has retired

from the presidency to become chairman of the board.

□ □ □

Ray P. Tarbell recently has been appointed manager of the welding division of the Ideal Electric & Mfg. Co., Mansfield, O. He has been active in the welding industry for 17 years, including 13 years with Lincoln Electric Co., Cleveland, as sales engineer and district manager, two years with Robert E. Kinkead Inc., Cleveland, and two years as manager of the welding electrode division of Babcock & Wilcox Co., Barberton, O.

Charles M. Schwab

"I am feeling very well, much better than I did a year ago," said the dean of the American steel industry, who celebrated his 73rd birthday anniversary, Feb. 18. "I was very much pleased with the gold decision. . . . I am standing behind the President and his program . . . hopeful that ultimately we'll be as prosperous as before . . . conditions are improving."

□ □ □

W. R. Gilmore has been elected president of the Superior Steel Co., Benton Harbor, Mich. Other officers include: Fred H. Johnston, vice president, and Charles H. Pratt, secretary. Board of directors includes these three and Charles Aaron.

□ □ □

James S. Watson, plant manager of the Link-Belt Co., Indianapolis, has been re-elected second vice president of the Associated Employers of Indianapolis by the board of directors. C. H. Bradley, president, W. J. Holliday & Co., has been elected to the board of directors of the employers' organization.

□ □ □

Hubert D. Tanner, for 15 years associated with Pratt & Whitney Co., Hartford, Conn., has been appointed manager of the machinery division. He has been in charge of the development of certain types of gear grinding machines.

Edward J. O'Malley has been named superintendent of all manufacturing divisions for Pratt & Whitney, in both machinery and Keller divisions.

Alden M. Drake, with the company for five years and lately chief engineer, assumes charge of a new department being formed for development of improved machines, tools and appliances for the production of small tools.

Carrol Knowles has been appointed chief engineer in full charge of the machinery engineering department. He has been with the company 17 years and for 15 years prior to that was associated with Brown & Sharpe Mfg. Co.

R. F. V. Stanton, with Pratt & Whitney for 18 years, has been made research engineer of the engineering division.

Eugene Sullivan has been named general foreman of all manufacturing in building No. 4 of the machinery division.

B. G. Denlinger has been made general foreman of the Keller division which prior to its absorption by Pratt & Whitney was the Keller Mechanical Engineering Corp., Brooklyn, N. Y. Mr. Denlinger was associated with the latter organization for 15 years.

□ □ □

L. K. Lindahl, for 12 years associated with the Udylite Co., Detroit, electroplating interest, has been elected vice president and general manager. He joined the sales engineering staff of the company in 1923 shortly after graduation from the University of Illinois. In 1929 he was named sales manager. Later he took over technical supervision and product development. Since 1929 the company twice has moved to larger quarters to provide room for expansion.

L. K. Lindahl

□ □ □

W. A. Neill has been named manager of a newly-formed mining and construction department of the Worthington Pump & Machinery Corp., Harrison, N. J. The new department is a consolidation of several of the company's contributing sales divisions in the mining, quarrying and construction equipment fields. Mr. Neill previously has been associated with Denver Engineering Works, Denver, Allis-Chalmers Mfg. Co., Milwaukee, and Dorr & Co. Inc., New York.

□ □ □

Ambrose Swasey, chairman of the board, Warner & Swasey Co., Cleveland, was presented with the 1935 Washington award at a dinner of the Western Society of Engineers in Chicago, Feb. 20. Sponsored by a number of leading technical societies, the award was conferred upon Mr. Swasey in recognition of services he has rendered and the inspiration his professional life has been to fellow engineers. Past recipients of the award include Herbert Hoover, Robert W. Hunt, Orville Wright, Michael I. Pupin and others.

U. S. Stand Cramps Him

Ivan V. Boyeff, new chairman of the Amtorg Trading Corp., New York, official soviet trading agency in the United States, expected to greatly increase his business as a result of negotiations between Ambassador Troyanovsky and Secretary of State Hull. But the state department proved unwilling to make a $100,000,000 loan in addition to waiving most of the soviet debts, and so Amtorg's trading, for the immediate future, will be limited to arrangements it can make privately with American manufacturers, most of whom still want cash

Search for Priority in Iron Leads to Central Europe

By Harry Craig Richardson

THIS article, second of a series of three, is an abridgment of an article by Mr. Richardson entitled, "Iron, Prehistoric and Ancient," published in The American Journal of Archaeology, Vol. XXXVIII, No. 4, October-December, 1934. The editors' permission to reprint is hereby acknowledged

OF THE excellence and abundance of iron ores in the Danube area there can be no doubt. Herein lay the Roman province of Noricum, comprising within its ancient boundaries modern Styria and Carinthia and such famous mediaeval arm-making centers as Innsbruck and Salzburg. Noric iron, long the criterion of excellence, was indeed familiar alike to metallurgist and poet. Pliny rates it as inferior only to iron from the Seres, or that made by the Parthians.

Modern testimony is equally laudatory. Jars, who visited this region in 1758, called attention to the fact that steel was frequently produced by direct reduction from the manganiferous spathics of the Styrian Erzberg of Eisenerz. These Eisenerz ores have been more recently discussed by Bauerman, who notes that "the production of steel blooms in the open charcoal fire (Rohstahlfeuer) is still carried on in some small mountain forges, but on an extremely restricted scale for special steelmaking purposes."

Europe Has Rebirth Period

Obviously good ores in sufficient quantity to provide for the needs of a primitive industry were available at, or near, Hallstatt.

The evidence is less absolute for the metallurgic progression of Central European peoples between 2000 and 1500 B. C., yet, in spite of this lack, continuity is discernible and the objections, after all, may be more apparent than real. Perhaps it is merely that the mind, grown accustomed to enormous lapses of time for the unfolding of European cultures, finds it incredible that in less than 500 years any people could acquire a knowledge of copper and bronze, and achieve the metallurgy of iron.

But the second millennium was, for Europe, an age of rebirth. Trade and migration were everywhere increasing, and with the exchange of material possessions came the interchange of ideas. Lying on the main amber routes, in touch with the Baltic, the Mediterranean and Aegean worlds, no region in the west was more susceptible to external influence than the Danube area.

Here, in the dawn of history, lived young and vigorous peoples constantly under pressure from migratory hordes moving down from the north. Alert, eager, conscious of growing power, they were unfettered by metallurgical tradition, and of necessity exploited the mineral wealth which lay at their hands.

If priority for the West rests chiefly on the evidence of objects, the claim of the Caucasus is an epic tradition without tangible proofs. No iron found in that area can be dated earlier than the Nimrud-Nineveh hoards of the eighth century B. C. Conceivably future discovery may show that the working of iron in the Caucasus is much older than can now be admitted. The possibility of this has already been a subject of much speculation; and de Morgan, noting certain similarities with Hallstatt forms, has tentatively suggested that Hellenendorf was the parent whence sprang the iron cultures of Central Europe. On the evidence as it stands today it seems more probable that the order of precedence was quite the reverse, and that Hallstatt, far from being the offspring, was the inspiration of Hellenendorf and other Caucasian cultures.

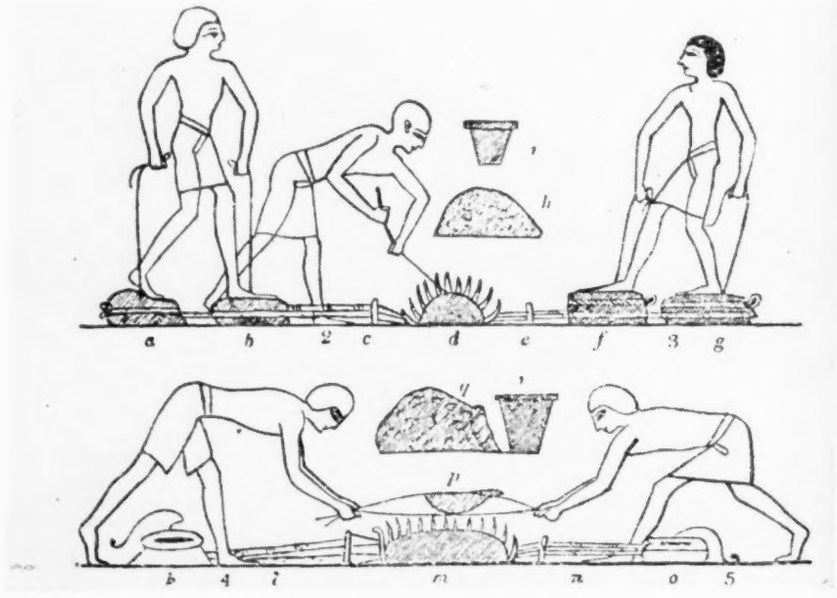
Iron among the Hittites appears to have been rare and only in the Late Period (1200-604 B. C), following submergence of the central kingdom, does it really begin to supersede bronze.

Asia Minor Ore Poor

The deposits of Asia Minor are, for the most part, low grade hematite with some occurrence of manganetite. Certain mines near Tarbali are said to produce both hematites and spathics.

Classical references point to only one source in all this vast region—the land of the Chalybes east of Sinope on the Black sea. Strabo, writing at the dawn of the Christian era, says that "the Chaldaei of today were in ancient times named the Chalybes." "Ancient times" is a relative term, and as used by him may be taken to mean some period, more or less remote, of which he had no specific knowledge. In the case of the Chalybes "ancient times" appear to fall somewhere between Homer and Aeschylus, or, between the ninth and fifth centuries B. C.

With Aeschylus, however, there is no mistaking the Chalybes as a nation of ironworkers, but with equal clearness the poet locates them north



Early blast furnace. A, b, k, and o represent a leather case; c, e, l, and n the pipe conveying wind to the fire; h and g, charcoal

of the Black sea and west of the Caucasus.

On the testimony of Herodotus and Strabo, the Scythians do not appear to have been users of iron until, driven from their home east of the Caspian by the Massagetae, and thrust westward, they came in contact with Cimmerian tribes moving east from Europe across the southern steppe-lands of Russia. The "ruthless Chalyb" thus appears to have been a Cimmerian-Scyth; and chronologically his arrival in Asia Minor can be placed late in the eighth century B. C., immediately before, or contemporary with, that wave of invasion which rocked the Assyrian kingdom and struck down the Phrygian state.

Knowledge of iron among the Chalybes therefore is seemingly traceable to Cimmerian influence, and through them, perhaps, to Central Europe. How they developed their undoubted skill is shrouded in mystery. It is not altogether improbable, that, like the natives of Hyderabad, the Chalybes evolved independently a crucible process.

THE second half of the Iron Age begins approximately at 500 B. C. and ends at the opening of the Christian era. Like the earlier or Hallstatt period, the late Iron Age, also taking its name from a representative type-site, is known as La Tene. Precisely defined, La Tene is a Gallo-Keltic culture; hence a late Iron Age is recognizable only in Europe north of the Alps. It is contemporary with Republican Rome and overlaps the high civilization of Greece, Persia and Macedonia.

The La Tene settlement lay on a bay at the eastern end of Lake Neuchatel, and the site was, for the first time, fully revealed when the water-level receded about 50 years ago. The almost complete absence of articles connected with domestic life indicates clearly enough that it was a military post, probably occupied by Helvetians during the third and second centuries B. C. Thus the civilization at La Tene itself falls within the middle period of the late Iron Age in Europe.

Kelts Spread Iron Knowledge

Where or when the first Keltic movement took place has not yet been determined, but early in the seventh century these warriors appear in the upper Rhine valley. Possibly the late Hallstatt (700-500 B. C.) culture can be traced to their influence; in any event, it was this mobile and conquering race that, in the years between 500 and 100 B. C., spread a knowledge of iron over northern and western Europe.

The growth and extent of this Keltic iron-working is revealed by the numerous exposed sites scattered throughout central Europe. At Gyular in Translyvania the remains of a furnace have been found. Two of the earliest and best known sites lie within easy reach of Hallstatt—the one in Carinthia on the upper waters of the Drave, the other in Styria on the Mur. Both localities, it is to be observed, are within the borders of what later became the Roman province of Noricum.

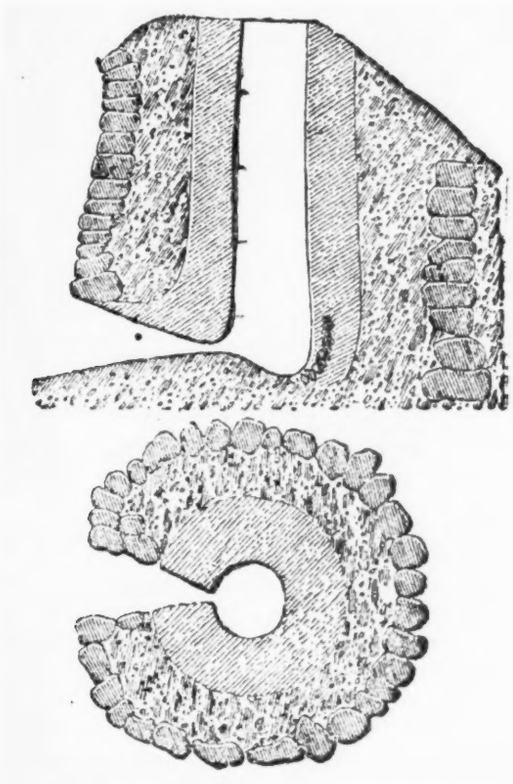
But of greater significance to the antiquary is the wealth of evidence uncovered in the Bernese Jura. Here within a limited area the complete cycle of early iron production—mining, refining and fabricating—has come into view. Not only that, but it has also been possible to date a large number of these various sites with reasonable accuracy by the tools and implements found with the remains. There is little doubt that the iron products of Jura traveled far; and it is more than probable that a great deal of the iron from La Tene itself originated in this region.

Obviously there must have been a wide variation in the quality of iron produced; and in those localities where good ores were rarely obtainable Keltic iron was unquestionably a very inferior product. Polybius, in his account of the wars with the Cisalpine Gauls, unmistakably points to a superiority of Roman over Keltic iron in the third century B. C. On the other hand, those tribes who most stubbornly contested Caesar's conquest of Gaul—the Aquitani, Bituriges, Sequani, Helvetii and Boii—were, one and all, located at, or near, the best iron ores of western Europe.

Iron Weapons Reinforced Bravery

The temptation here is strong to ascribe the more determined resistance of these Gallo-Keltic tribes to better iron weapons—a speculation that borders upon conviction when it is also observed that the "most courageous" of all the Germans, the Belgae, dwelt near the spathic deposits along the Sieg, and that the "most war-like" Suebi occupied Noricum. In later times, the Siegerland was the home of those Germanic Cherusci who destroyed the legions of Varus; there, too, lived the Chatti of whom Tacitus said, "their whole strength lies in their infantry whom they load with iron tools and baggage; other Germans may be seen going to battle, but the Chatti go to war." Great as it undoubtedly was, Keltic iron-working had little effect on civilization south of the Alps or east of the Bosphorus.

Greece, even at the zenith of glory and power, was never outstanding as a producer of iron. She did acquire, it is true, a considerable facility in working it, but the best, and by far the greater proportion of her iron was imported in semifinished condition. Sparta is perhaps the single exception. The mines of Laconia were apparently adequate for her slender need, for, though iron was



Ore furnace, Bernese Jura, (After Quinquery)

used in every conceivable product, the amount required was relatively small.

The Greeks of the epics, while acquainted with iron, are seemingly without knowledge of mining or production methods. It is quite clear, in fact, that the Greeks of Homer regarded iron as a semi-precious metal to be used sparingly for implements; occasionally, perhaps, as utensil-currency. In Homeric Greece every community had its forge, which was, indeed, the only workshop. Thither came the artisans and landowners for the ever necessary tools and implements. Many brought with them unworked lumps of iron, bronze or copper which the forge-master (chalkeus) fabricated to order. Not infrequently the working of iron was a part of domestic industry on the larger estates; or, if the job was too complicated, the chalkeus would be sent for to do his work on the premises. In such cases the metal was always furnished by the proprietor from his "treasury."

Tempering Wholly Empirical

The equipment and tools of the forge-master were of the simplest kind—anvil, tongs, hammer and hand-bellows. The fuel was usually charcoal. Unquestionably, through long experience, the chalkeus learned that certain heating conditions tended to harden (carburize) the iron, and that further hardening was possible by a water quench. But the subsequent refining and toughening by reheating was beyond the early Greek iron-workers, as they lacked the proper facilities to determine, or control, temperature.

One hundred years after Homer, or late in the eighth century, Hesiod reveals a considerable knowledge of metallurgy; and he skilfully differentiates between the melting of tin by a crucible process and the "softening" of iron in "glowing mountain fires." But, by then, knowledge of iron had become universal. It was the age of Sargon and the hordes at Nineveh. And while Hesiod was lamenting in lofty Greek verse the approach of an iron age, even then, the Chalybes were settling on the Black Sea coasts and late Hallstatt Europe was preparing the way for Keltic La Tene.

Welding Advances Use of Metals

Metallurgy, concentrated first at Miletus, Ephesus, Samos, passed to Euboean Chalcis, and early in the seventh century was a highly developed craft on the mainland at such centers as Corinth, Sicyon, Aegina and Athens. From the mother cities, metal-working spread to the colonies; the metallurgists of Magna Graecia in their turn becoming the instructors of Etruria and Rome.

By the end of the seventh century the simpler Homeric methods of hammering and casting had been superseded by a more developed technique. Glaukos the Chian had then invented the welding of iron, and the Samians had discovered, or borrowed, a process of hollow-bronze casting. Both inventions, especially the welding of iron, immeasurably advanced the use of metals. It was shortly thereafter that the iron deposits of Euboea and Boeotia began to be worked.

In the Athens of Pericles iron-working was carried on chiefly by resident aliens. They were the smiths, the manufacturers of tools, implements and weapons. Two of the largest workshops ever known in Greece were the armor factories of the aliens Kephalos and Pasion. Sophocles' father was a blacksmith, and the patrimony of Demosthenes included a sword factory.

Until about 330 B. C. prices for iron ore appear to have fluctuated between $1.25 and $1.50 (silver) per 100 pounds. Then a boom, due partly to the speculative opportunities created by the wars of Alexander, quadrupled the price. For in Greece of the fourth and third centuries speculation frequently upset supply and demand, and the "corners" in oil, manipulated by the astronomer Thales, were imitated many times with metals and other commodities. It is on record that a Sicilian banker of the fourth century, having bought up all of the available and anticipated output of iron, once cleared a profit of over 200 per cent.

Iron Crosses Alps to Italy

Early in the second millenium Bronze Age invaders from beyond the Alps swarmed down upon and seized the fertile plains of North Italy. A few centuries later other invaders, seemingly a kindred people, have crossed the Po and are taking up land as far south as the Tiber. Primarily agriculturists, these Villanovan newcomers are now credited with the introduction of iron into Italy. And it was a southern branch of this race, the so-called Italici, to whom is attributed the founding of Rome.

The best known and most carefully studied evidence of this civilization has been collected in the Bologna district. There iron was in daily use not later than 900 B. C. Not only has it been possible to trace here the gradual transition from bronze to iron, but Villanova also reveals many features characteristic of Hallstatt—analogies striking enough at least to warrant belief that both cultures developed from a common stem.

It cannot be claimed that Villanovan civilization itself directly influenced Rome, but indirectly, in its Etruscanized form, it created that city. For those Tyrrhenian immigrants who landed on the Italian coasts in the eighth century mixed with the autochthonous Villanovan stock and became the Etruscans of history. There is nothing to indi-

(*Please turn to Page 78*)

The Iron Industry: Hallstatt type swords and daggers, western Europe

EDITORIAL

Congress More Hostile to Industry than Administration

PRESIDENT ROOSEVELT'S message to congress calling for a two-year extension of NIRA indicates a change of procedure which may put a new aspect on the relations of business with the federal government.

Thus far in his administration, the President has been extremely specific in his recommendations to congress for legislation. Many of the so-called "administration" bills have been drafted under White House supervision by executive rather than legislative personnel. Recently members of both parties have protested violently against this assumption by the executive branch of prerogatives traditionally exercised by the legislative branch. Congress now is in a mood to insist that it be permitted to write its own bills.

Consequently, in the message on extension of the recovery act, the President apparently is acquiescing in these demands. Instead of stating specifically what he thinks should be included in the new act, he presents a broad outline of features he believes to be desirable. Then, in the following words, he clearly puts up to congress the job of drafting the bill:

> "Detailed recommendations along the lines I have indicated have been made to me by various . . . . agencies . . . . These are available for the consideration of the congress and, although not furnishing anything like a precise and finished draft of legislation, they may be helpful to you in your deliberations."

It was inevitable that sooner or later the framing of laws—assumed by the executive under the stress of emergency—should be returned to the legislators. However, it may prove to be unfortunate for the interests of business that the shift happens to take place at the time when NIRA, short week, labor disputes and other bills affecting industry are under consideration.

Many Congressmen Believe Industry Is Attempting To Ruin New Deal by Sabotage

The danger lies in the fact that the present congress is decidedly hostile to business of all kinds. In many respects, a considerable number of members of both houses today view business, finance and industry with the same suspicion and animosity which characterized the attitude of the early brain trusters in 1933. Whereas the administration has purged itself of many of the most obnoxious baiters of industry, the senate and house have not. In fact the proportion of legislators hostile to industry is higher today that it was in the last congress.

Almost two years of experience in attempting to administer new deal legislation have served to take the edge off the early hostility which administrative spokesmen displayed toward business. Lacking the benefits of this chastening experience, many members of congress still are striving blindly to imitate the "crack-down" tactics pursued by the administration in 1933.

This is particularly true of many of the congressmen who were swept into office on the coattails of the new deal. Most of them are extremely sensitive to criticism of new deal policy and legislation. They assume that whoever dares question any phase of the new deal is trying to prevent its success. Because industry has opposed certain provisions of the recovery program, these congressmen believe that industry is "on strike"—that it is trying to kill the new deal by sabotage.

Desire To Punish Is Evidenced in Bills Unnecessarily Detrimental To Industry

Naturally persons holding such views are vindictive. Many public servants on capital hill sincerely believe they have a clear-cut mandate from their constituents to go as far as they like in punishing industry for its alleged sins. Evidence of this is found in scores of bills introduced in the first few weeks of this session.

There are bills to further hamper the railroads by limiting by law the length of trains, providing that men be added to train crews whether needed or not, authorizing government inspection of railway track and signals (in spite of the fact I.C.C. already provides ample safeguards), etc. The 30-hour bill, the new labor disputes bill, the Wheeler threat to heap confiscatory taxes on corporate bigness, and dozens of other proposals being thrown into the legislative hopper bear strong traces of the effort of congress to punish industry.

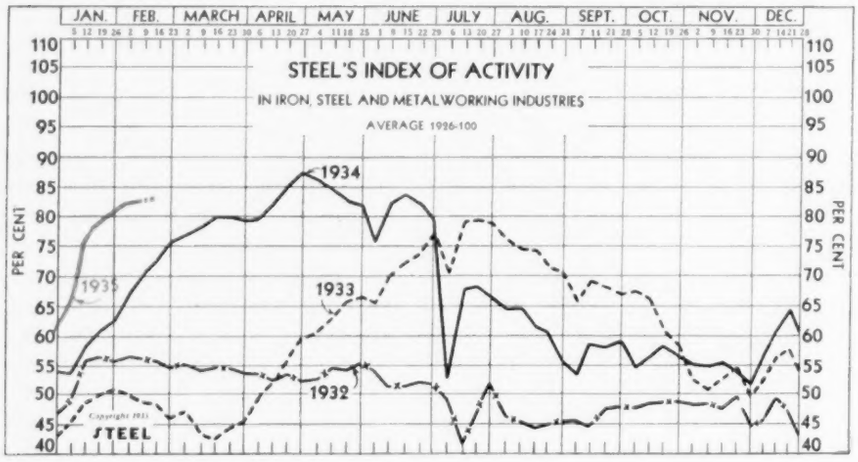
Unfortunately not one congressman in ten has anything but a vague and distorted idea of what industry is. Most of them think it is a collection of gigantic corporations. Even those who profess to sympathize with the small business man, frame laws designed to curb big business but which in effect harm the little fellow.

It will be a miracle if industry obtains a reasonably just extended recovery bill at the hands of congress. It will be a miracle if industry receives anything but harsh treatment until legislators learn that industry is the machinery for the production of national wealth and not—as many of them now assume—a sinful scapegoat to be sacrificed to the ogre of depression.

THE INDUSTRIAL DIAL

Published in the last issue of each month as part of
The Business Trend Section of STEEL

Copyright 1935 by Penton Publishing Co.



STEEL'S *index of activity in the iron, steel and metalworking industries gained 0.3 points to 83.0 in the week ending Feb. 16:*

Week ending	1934	1933	1932	1931
Dec. 22	64.4	58.0	46.9	52.3
Dec. 29	60.8	53.7	42.9	46.8
	1935	1934	1933	1932
Jan. 5	65.4	53.6	45.3	48.8
Jan. 12	73.8	58.1	48.6	55.8
Jan. 19	78.1	60.9	49.8	56.2
Jan. 26	79.5	62.3	50.8	55.8
Feb. 2	81.8	66.9	49.9	56.2
Feb. 9	82.7†	70.7	48.7	56.0
Feb. 16	83.0*	72.4	48.3	55.5

†Revised. *Preliminary.

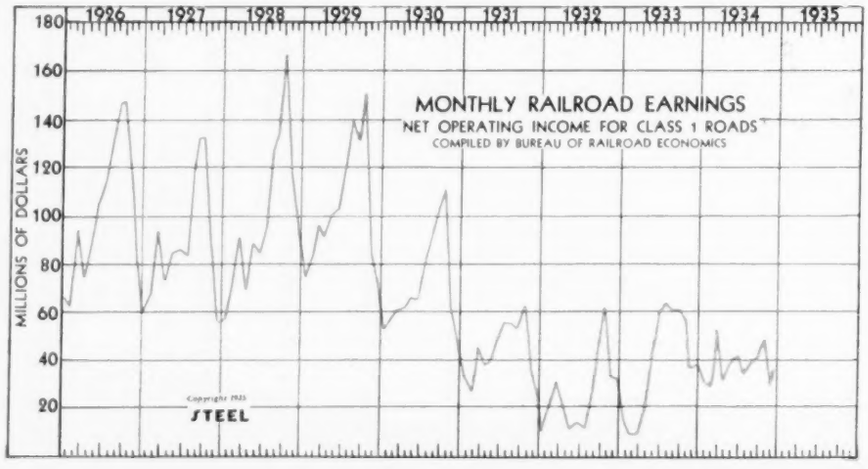
Lifting of Uncertainties Should Help Business

OF TWO domestic factors which caused uneasiness in business circles during most of February, one—the suspense over the pending gold clause decisions—has been disposed of definitely, and the other—possibility of strikes in the steel and automobile industries—appears to be somewhat more remote as the end of the month approaches.

If all that was said about the projects that were held in abeyance while the gold decision was pending were true, one could expect the release of a large volume of orders following the supreme court's action of last Monday. Some evidence of an increase in the authorization of capital expenditures has appeared since the decision was announced, but it still is too early to judge the extent of these releases accurately. It is certain, however, that business sentiment generally was improved to a marked extent by the lifting of the uncertainty which attended the gold cases.

While the labor situation continues to cause concern in some quarters, developments of the past few weeks indicate that the task of those sponsoring the threatened strikes in steel and autos daily is becoming more difficult. Public opinion has been shifting away from A. F. of L., and today President Roosevelt is in a position to clamp down hard on professional unions if they use unfair tactics in throttling the automobile industry, which unquestionably is the present mainstay in the drive for recovery. Moreover, auto partsmakers have been making minor

1934	
Jan.	$30,931,202
Feb.	29,281,013
Mar.	52,037,848
Apr.	32,264,610
May	39,494,978
June	41,836,302
July	35,220 890
Aug.	39,677,337
Sept.	41,020,485
Oct.	48,624,984
Nov.	31,582,704
Dec.	38,729,833


1926 1927 1928 1929 1930 1931 1932 1933 1934 1935
MONTHLY RAILROAD EARNINGS
NET OPERATING INCOME FOR CLASS 1 ROADS
COMPILED BY BUREAU OF RAILROAD ECONOMICS
MILLIONS OF DOLLARS
STEEL

1933	
Jan.	$13,585,011
Feb.	10,133,779
Mar.	10,805,518
Apr.	19,351,463
May	41,042,629
June	59,831,292
July	64,752,602
Aug.	61,401,984
Sept.	60,608,882
Oct.	57,366,046
Nov.	37,662,122
Dec.	37,726,339

concessions to labor groups to offset incipient trouble. In the steel industry, the drastic efforts of the Amalgamated association to purge itself of insurgents probably will serve to postpone, if not abandon, threatened strike action. At the moment, the situation is more acute in the accessories division of the automobile industry than in automobile assembly plants or in the steel industry.

With uncertainties narrowed down to sporadic labor clashes and the ever present annoyance of anti-industry legislation in congress, business has a somewhat clearer road ahead than it has witnessed in many months.

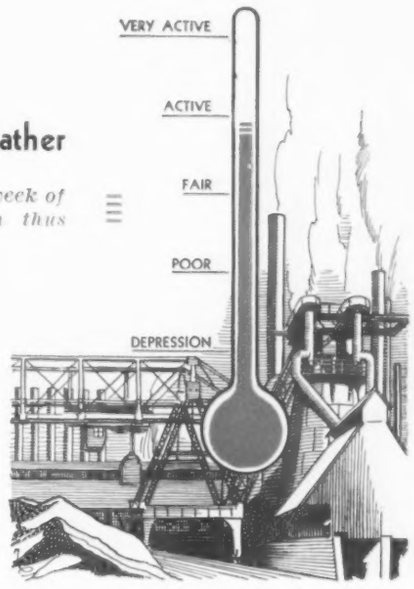
Industrial activity has been maintained at a fair rate, in spite of the recent slackening of pace. Some of the weekly business indexes which are adjusted for seasonal variations have shown moderate recessions from the levels of early February. Others, like STEEL's index of activity in the iron, steel and metalworking industry, which are not so adjusted, have leveled off but thus far have not turned downward definitely.

In these indexes, the strong upward movement of automobile production, coupled with steadiness in freight traffic, electric power output and similar barometers, has tended to offset the decline in steelworks operations. Probably the most encouraging feature of the present situation is the growth in expenditures for plant and equipment rehabilitation.

Industrial Weather

Change from last week of January is shown thus ≡

TREND: *Moderate Improvement*



Where Business Stands

Monthly Average, 1934—100

	Jan., 1935	Dec., 1934	Jan., 1934
Steel Ingot Output	129.2	95.6	91.0
Pig Iron Output	108.8	75.7	90.2
Freight Movement	91.7	88.8	91.9
Building Construction	.....	72.4	75.3
Automobile Output	128.4	77.1	69.6
Wholesale Prices	105.4	102.3	98.2

The Barometer of Business

Industrial Indicators

	Jan., 1935	Dec., 1934	Jan., 1934
Pig iron output (daily average, tons)	47,692	33,153	39,537
Machine tool index	61.3	54.1	103.6
Finished steel shipments (tons)	534,055	418,630	331,777
Ingot output (daily average, tons)	104,969	77,645	73,959
Dodge Bldg., awards in 37 states (sq. ft.)	.....	9,193,300	9,568,700
Automobile output	310,000	185,919	167,910
Coal output, tons	31,495,000	31,386,000	32,935,000
Business failures; number	1,184	963	1,364
Business failures; liabilities	$18,823,697	$19,910,610	$32,905,428
Cement production, Bbls.	.....	4,447,000	3,779,000
Cotton consumption, bales	.....	414,000	508,000
Car loadings (weekly av.)	542,618	525,990	544,390

Financial Indicators

	Jan., 1935	Dec., 1934	Jan., 1934
25 Industrial stocks	$143.88	$141.31	$142.28
25 Rail stocks	$27.78	$28.99	$37.18
40 Bonds	$82.98	$81.75	$76.62
Bank clearings (000 omitted)	$21,268,788	$19,730,718	$17,740,951
Commercial paper rate, N. Y. (per cent)	1	1	1½
*Commercial loans (000 omitted)	$7,591,000	$7,653,000	$4,740,000
Federal Reserve ratio, per cent	71.8	70.8	63.9
Railroad earnings	$38,729,833	$31,582,703	$37,763,879
Stock sales, N. Y. stock exchange	19,409,752	23,587,502	54,567,209
Bond sales, par value	$332,540,800	$274,105,700	$440,984,700

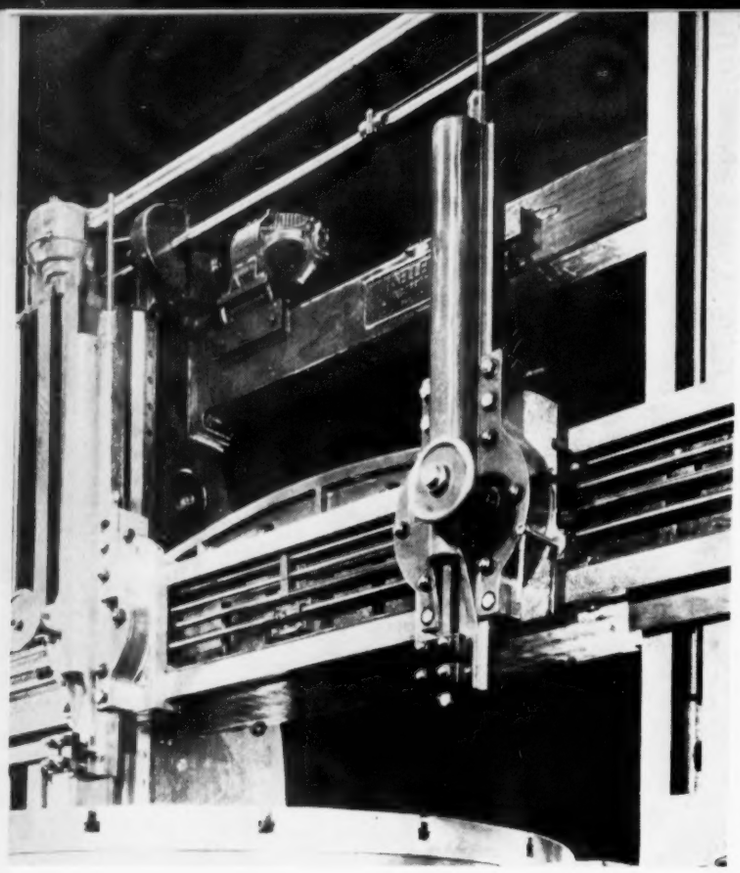
*Leading member banks Federal Reserve System.

Foreign Trade

	Jan., 1935	Dec., 1934	Jan., 1934
Exports		$170,676,000	$172,000,000
Imports		$132,252,000	$128,536,080
Gold exports		$140,000	$4,715,000
Gold imports		$92,249,000	$1,947,000

Commodity Prices

	Jan., 1935	Dec., 1934	Jan., 1934	Mo. av. 1913
STEEL's composite average of 25 iron and steel prices	$32.58	$32.39	$32.42	$26.32
Bradstreet's index	$9.78	$9.49	$9.01	$9.21
Wheat, cash (bushel)	$1.13	$1.15	$1.06	92c
Corn, cash (bushel)	$1.04	$1.06	66c	51c
Petroleum crude (Bbl.)	98c	98c	98c	$2.50



MATERIALS USED IN OF MODERN MACHINE

BY B. K. PRICE
Associate Editor, STEEL

Fig. 1—Large boring mill, with 16-foot swing. Cast iron and cast and rolled steel enter into its construction

SELECTION of iron and steel for use in the construction of modern machine tools involves a number of important considerations, such as strength, wearing quality, machinability, resistance to abrasion and corrosion, weight, appearance, hardness and not infrequently the grain structures.

At the plant of William Sellers & Co. Inc., Philadelphia, strict attention is paid to these various factors, and the practice pursued is of special interest, for the company not only has long been prominent in the machine tool industry (it was organized in 1848), but builds a wide line of machinery, including drill and tool grinders, planers, planer-type millers, horizontal boring, drilling and milling machines, boring mills, railroad shop tools and special machines.

Castings Dampen Vibration

Cast iron usually is selected for the larger elements. It is sufficiently rigid in most cases and provides enough mass to minimize vibration, and permits good appearance. Moreover, it is generally less expensive. Cast and fabricated steel, however, are used for some major sections, where strength is of special importance. For example, cast steel is used for the ram on the company's vertical boring mill because of its greater strength and stiffness. The cross rail brace on its open-side planer is of steel, but in this case fabricated and welded steel, mostly steel plates. For this purpose three characteristics are desired—strength, rigidity and lightness. Welded steel is sometimes used, provided there are no casting patterns, for certain simple parts, such as motor bases and brackets.

Where strength is not important, but it is necessary to keep down weight, aluminum is used. Certain parts of the overhanging arm on the company's new boring, drilling and milling machine, and the cover on the head, are of aluminum.

In the selection of cast iron, the grade is carefully considered for the work to be performed. For movable parts and those having bearing surfaces, high grade close grain iron is used. The best iron for this purpose, it is said, is obtained by inclusion of steel, not only increasing the strength, but reducing the graphitic carbon and producing a fine grain.

Types of steel selected in welded structures also vary, depending upon the work. Perhaps the main portion of the steel used is boiler plate, but for wearing surfaces, cromansil (chromium-manganese-silicon) steel or a steel faced with cast iron plates is required. Cromansil is particularly desirable, it is declared, for it will go through annealing without losing hardness.

Composition of steel casting also depends much upon the duty required. For instance, to withstand shock and continued blows, such as from a hammer, one material is selected; if the steel is for a wheel lathe turret requiring strength and resistance to abrasion from chips, still another material is required.

As for smaller parts, various materials are selected. For spindles, requiring accuracy of size, strength, resistance to abrasion from chips, the company uses nitralloy because its surface can be made hard without distortion when properly treated. For spindles, not requiring hardness, because they are not subjected to the abrasive action of chips, chromium-nickel alloys are specified, particularly chromium-nickel-molybdenum, which has the quality of being machinable, with relatively high hardness.

Choice of Steel for Gears

Gears are usually of chrome-nickel alloy, either S.A.E. 3140 or 3250, depending on the service and the strength required. It has always been found preferable from a cost standpoint to use S.A.E. 3140 steel as the heat treatment is completed before machining. Where S.A.E. 3250 steel is used for gears, a normalizing process usually is necessary before the finish machining, and the bore and teeth generally have to be ground after final hardening.

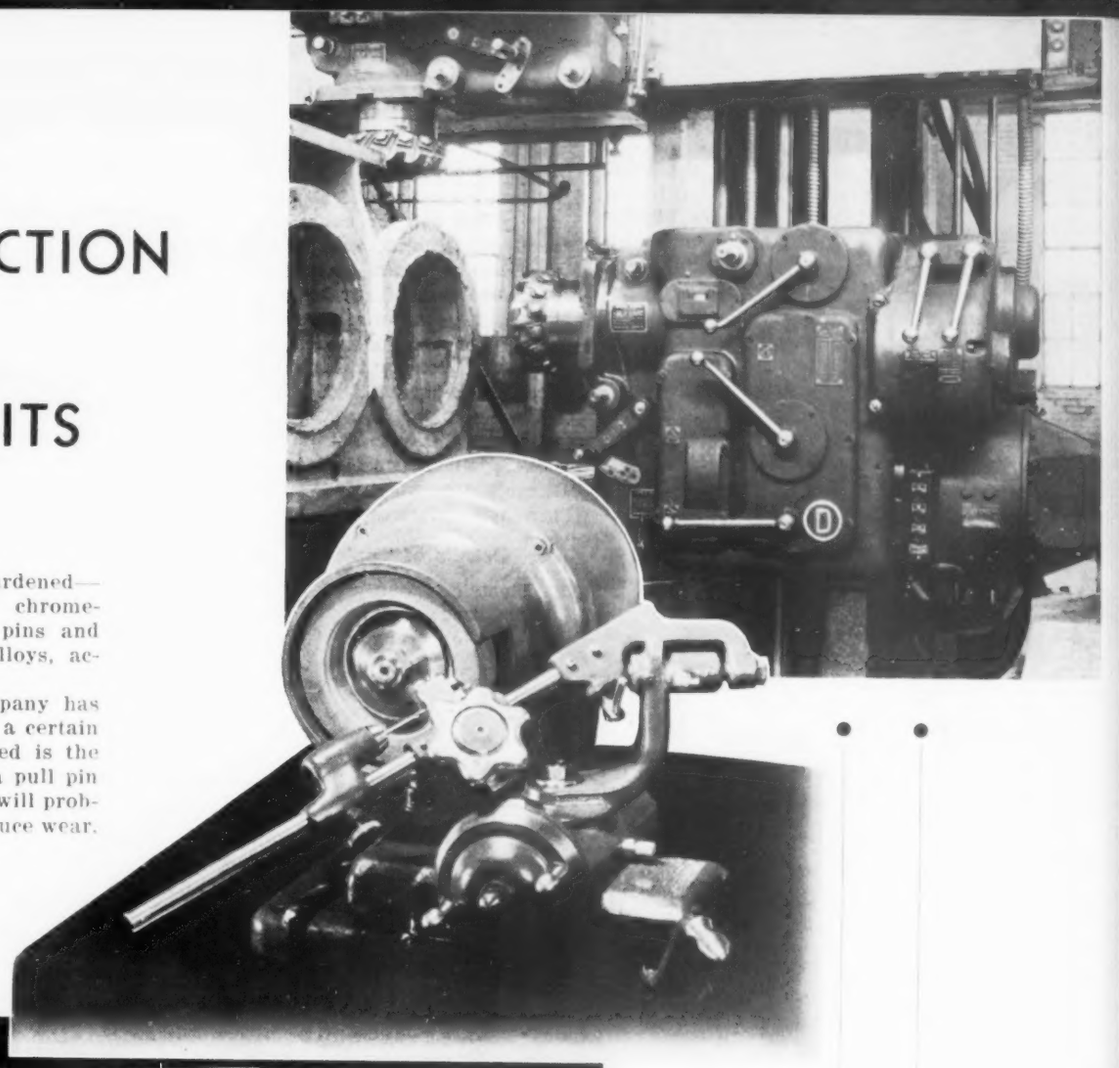
Chromium-nickel steel gears are usually carried on chrome-nickel shafts which may be forged or turned from hot-rolled bars. For shafts of the lower stresses and for long splined shafts and screws, the company selects machinery steel S.A.E. 1035 or 1055. Where a large portion of a shaft is of one diameter, it is economical to buy ground shafting, finished close to size on centerless grinders.

Nearly all bolts located on machines in positions where they can be seen are made socket-head because of their more attractive appearance. The

CONSTRUCTION TOOL UNITS

bolts are of alloy steel, hardened—either chrome-nickel or chrome-vanadium. Special bolts, pins and the like, require special alloys, according to function.

For shear pins, the company has found by investigation that a certain chrome-nickel alloy hardened is the most satisfactory. If it is a pull pin to locate a selection lever it will probably be case hardened to reduce wear.



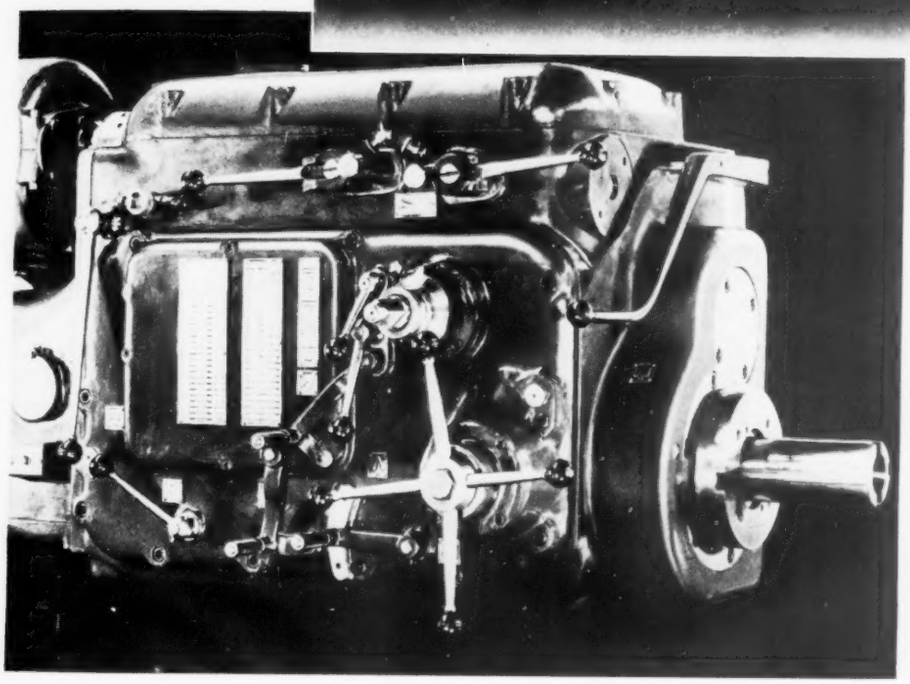


FIG. 2 (Top)—Head for a planer-type milling machine, embodying a variety of materials, including cast iron, ground shafting, chrome-nickel-molybdenum steel and stainless steel. Fig. 3 (Center)—Drill sharpener, mainly of cast iron. Careful attention was given to appearance of this unit. Fig. 4 (Bottom)—Head for a combination horizontal, boring, milling and drilling machine, revealing application of a variety of steels, cast iron and other materials

If it is a bolt or nut exposed to action of water on a grinding machine, it will be made of stainless steel—these, to cite a few examples.

Case hardened parts are made of commercial bars, S.A.E. 1112 and 1120, where threads are to be cut, and S.A.E. 1015 steel where the stock is to remain unthreaded. Parts subjected to higher stresses require chrome-nickel S.A.E. 3140 or 3250.

Die castings are used in the production of machines where they are required in sufficient quantities to justify the manufacture of dies. In some cases these die castings are chromium-plated to resist the abrasive action of dirt and grit.

Bakelite or some similar composition is used instead of metal on certain machines for high-speed pinions, to reduce noise. Bakelite handles are used on control levers for many machines.

All scales, verniers and dials are of stainless steel, so that they will not rust or discolor. Stainless steel castings are used where part of the castings are to be machined and polished to provide a zero line for scale or dial. For counterweight ropes, the company uses plow steel cable because of its flexibility and strength, and sometimes lead for the counterweights where space is limited.

Bronzes are selected in most cases for wearing quality, with various grades for various applications. Bushings, without excessive unit-bearing

pressure, are satisfactorily made of phosphor bronze; where pressure is high, special alloys are used. Phosphor bronze is satisfactory for many feed nuts, but where nuts and gears are combined, the alloy must be selected which will give strength to gear teeth as well as good bearing qualities to the nut. Incidentaly, there are many special applications where special alloys have been developed experimentally.

Most modern machine tools have built-in lubricating systems. The Sellers company uses aluminum tubing wherever the system requires constant circulation of oil from the reservoir through a system and back again. In a lubricating system where the oil is fed by gravity or forced through the bearings under pressure and not returned to the tank, either copper or aluminum tubes are used. Selection of lubricants is carefully considered, usually with the assistance of lubricating engineers of one or more of the larger oil companies. Instruction plates, attached to various parts, advise the operator where and when to fill and what grades of lubricant to use.

Paint and its application come in for important consideration in the finishing of machine tools. For the inside of gear boxes which have been pickled to remove sand, the company uses a paint that is oil-proof and sufficiently hard to withstand shocks of use. This paint acts as a seal on the castings, prevents any loose particles from working out of the pores; and also facilitates the cleaning of the inside of gear boxes when this is desired.

Where castings are not machined, the surfaces are all carefully primed, filled, rubbed down and painted to give a good appearance. In some cases lacquer is used to provide a glossy surface. Incidentally, steel gray is used in finishing all machines.

Nameplates are of aluminum ordinarily because the color matches the steel parts, and, in the opinion of company officials, gives a better appearance than either brass or bronze, which were at one time used extensively for this purpose. For speed and feed plates containing many figures and where the company does not have need for a sufficient quantity of these plates to set up dies, it has developed a process for producing these plates which is somewhat similar to the electrotype.

Details of Typical Machines

Electrical equipment is selected primarily according to the functions which the motor has to perform and the method desired to control it. The space available is also considered, although it is secondary. Electrical equipment must always be furnished to suit the current available at the plant for which the equipment is intended.

Fig. 1 shows a large boring mill, with a 16-foot swing. The main members are of cast iron, while the tool bars (5-foot stroke) are of cast steel. The large circular table gear ring is of rolled steel. Sheet metal is used to cover the gearing, there being no stress or wear, but rather only the need for a protective covering.

Fig. 2 is a 20-horsepower head for planer-type milling machine, equipped with a flange-type motor. The housing and larger parts are all cast iron, while the shafts and screws are made of ground shafting, S.A.E. 1035. The spindle quill is of chrome-nickel-molybdenum steel. Stainless steel is used in the circular scale and in the cover over it. The lubrication instruction plates are of enameled aluminum.

Fig. 3 shows a drill sharpener, for handling diameters from 1/16 to ½-inch. Most parts are of cast iron. The motor parts are purchased and fitted to the machine. Some chuck parts are made of die castings, chromium plated. Parts that actually come in contact with the drill are of hardened tool steel and are replaceable. Incidentally, the paint job came in for considerable care, appearance being especially important in a small machine of this type.

Fig. 4, showing details of the head of the company's new combination horizontal boring, milling and drilling machine, reveals the application of a variety of steels and other metals and materials. The head is of cast iron with 30 per cent steel and nickel and has a cover of aluminum. Bakelite bulbs may be noted on the ends of the operating levers. Visible also are alloy steel socket-head screws. The feed and speed plates are developed by a special process somewhat similar to electrotyping. The micrometer dial is of stainless steel, and the flow indicator of chromium plated brass. The straight levers are of rolled steel and those with a bend of cast steel.

On this combination machine chromium nickel steels, S.A.E. 3250, and 3140, are used in the gears, driveshafts and the spindle sleeve, the latter being supported in tapered roller bearings which contain nickel-molybdenum steel in both races and rollers. Stainless chromium-nickel steel is specified for the table and upright scales.

New Texas Racing Plant

SPEEDY STEEL CONSTRUCTION: Erection of the steel framework for the new race track grandstand at Houston, Tex., was accomplished in 19 days. McClintic-Marshall Corp. was the erector; Funk & Wilcox Co., architect; Mark Linenthal, engineer; Standard Construction Co., Houston, general contractor. About 600 tons of steel was used

Develops Rust Inhibiting Primer for Metals

Resistance to the formation, development and progression of corrosion or rust on the surface of dural, aluminum, alclad, steel and cadmium plated parts is afforded by a new zinc chromate primer now being marketed by Berry Bros., Detroit. The corrosion inhibiting properties appear to be derived from the electrolytic depolarizing action of chromate ions which are liberated by the water soluble nature of the pigment.

Tests disclose the primer to be 50 per cent lighter in weight than the conventional iron oxide and 75 per cent lighter in weight than basic lead chromate per square foot of area. This means a saving of 12 to 25 pounds or more on a ship, depending on the type and construction. As furnished in a heavy viscous state the pigment must be reduced 200 to 300 per cent with toluol for spray applications.

The material will dry to handle in not more than five minutes and will bend without cracking after being baked at 350 degrees Fahr. for 48 hours. For best results it is desirable to allow six hours for drying hard and tough.

SERVICE ENGINEERING

How One Company Keeps Bearings "Sold" by Careful Attention to Complaints of Customers

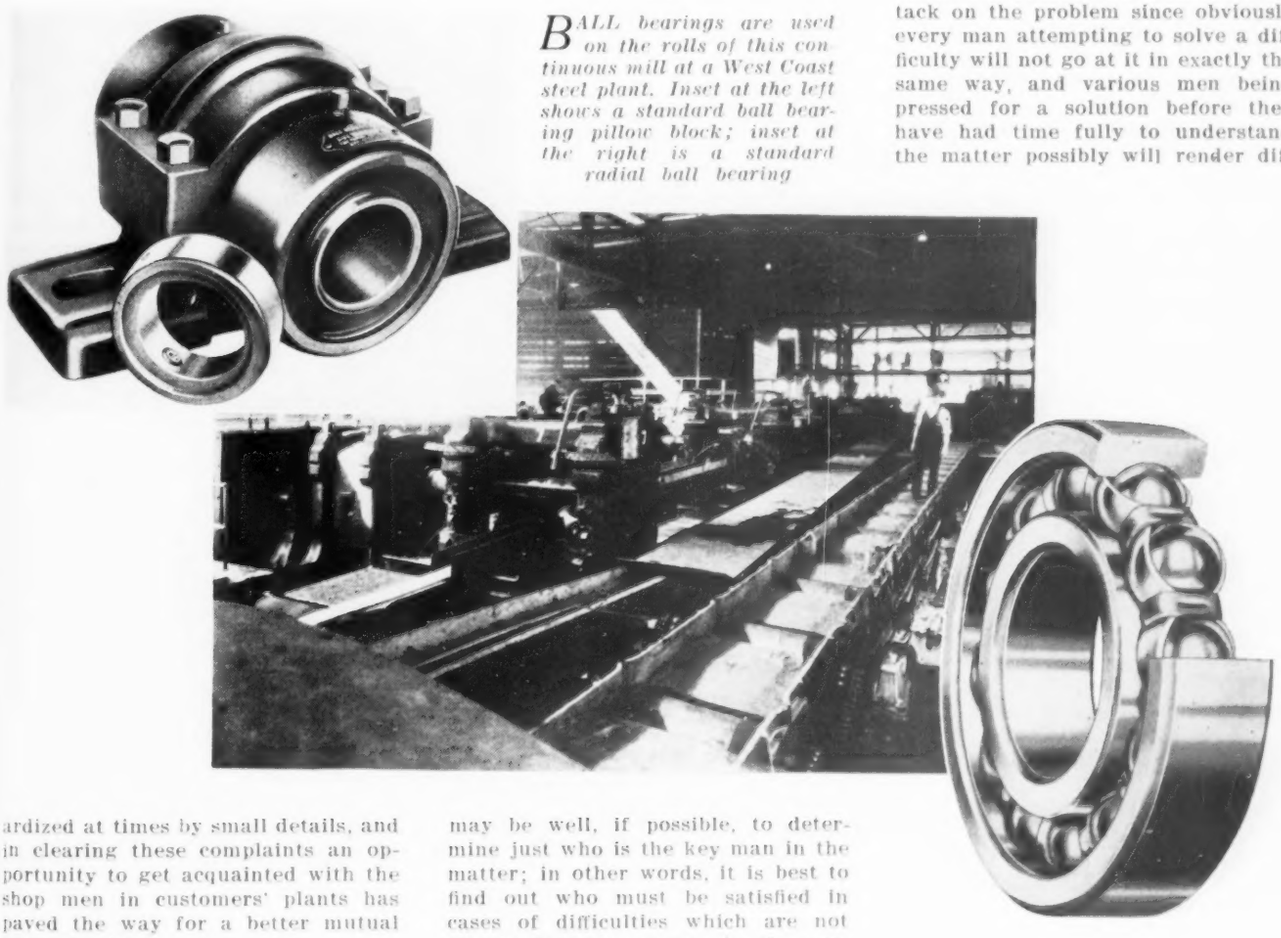
SOMEONE, a long time ago, adequately described service engineering on bearings as work which kept bearings sold. A few small difficulties quickly straightened out may prevent loss of business and provide opportunity for promoting closer understanding between the seller and his customers. Some larger accounts have been temporarily jeopardized at times by small details, and in clearing these complaints an opportunity to get acquainted with the shop men in customers' plants has paved the way for a better mutual understanding.

It is not necessary, however, for actual troubles to develop before stepping into the character of a service engineer, since many times difficulties can be prevented by contacting from time to time with men actually using the product. It is recommended that this contact be made wherever it is possible. This does not mean, however, that service men should go out huuting for trouble.

The first step in the solution of any field difficulty, of course, is a clear understanding of just what the difficulty is. At the earliest possible moment, the matter should be boiled down to the real facts of the complaint, with opinions definitely tagged as opinions, and facts definitely tagged as facts. Further, it may be well, if possible, to determine just who is the key man in the matter; in other words, it is best to find out who must be satisfied in cases of difficulties which are not clearly defined. It may be the purchasing agent, it may be the engineer, it may be shop men, or it may be a customer's customer. There is a tendency to exaggerate the difficulty as it is passed from the man who originated it. Another thing to be done is to prevent, as far as possible, changing everything at once. If a number of changes are made, the real solution of a difficulty may be lost and no worthwhile information secured.

It helps at times to find out whether the difficulty has developed slowly, or whether it has arisen suddenly, and as much accurate past history of the application as can be learned, is valuable. Another point is that some users get excited at the first sign of any difficulty and call in engineers from all ball bearing companies at once. This results in a confused attack on the problem since obviously every man attempting to solve a difficulty will not go at it in exactly the same way, and various men being pressed for a solution before they have had time fully to understand the matter possibly will render different opinions. This tends to discredit the whole attack and unsettle the customer. Therefore, it is well to ask the customer for undivided time in helping him.

A clear statement of the difficulty will do much toward a successful diagnosis. If the complaint is noise, for example, there are certain things



BALL bearings are used on the rolls of this continuous mill at a West Coast steel plant. Inset at the left shows a standard ball bearing pillow block; inset at the right is a standard radial ball bearing

which should be checked. If the complaint is heat, there are others to be investigated. If bearings are failing, there are other lines of attack.

If the difficulty has been reported as noisy operation, it can be established immediately as to degree. Obviously, damaged balls and raceways are identified easily. A damaged inner ring results in a continual but pronounced noise. A damaged ball produces noise pronounced in intensity, but varying in frequency and duration. The frequency may be extremely irregular if the action in the bearing is such that the damaged point comes against the raceway infrequently. A damaged outer ring, of course, is somewhat similar to the characteristics of a damaged inner ring, except that the noise frequency is much lower.

In cases of damage to inner rings, balls or outer rings, of course, a variety of causes must be checked. If segregations or inclusions in the steel are present close to the load carrying surfaces, the area may spall out. It is sometimes well to check the actual service rendered by the bearing in definitely blaming the material. A segregation or inclusion in the steel is liable to show up early in bearing service, and if a bearing is operated for two or three years, it is not fair to blame the material, since the spall may be caused by entirely good material reaching its fatigue limit.

Overload May Be Factor

Another cause of damaged material is overload, pure and simple, from either improper shaft or housing fit, belt loads, gear loads, and whatever else may be present in the machine to load the bearing abnormally. If extremely objectionable noise arises with the first revolution of the shaft, it is likely that the bearing has been damaged in mounting it, either by hammering it or unduly forcing it into place, by getting dirt into it or improperly clamping up nuts, housings or other parts.

Another cause of noise may be the rattle of a retainer, which was loose initially or caused to run loose by dirt in the bearing lapping down the balls, retainers and races until all parts fit together loosely.

Noise also may develop from pitting or corrosion of raceways during period of idleness, and showing up immediately after returning a unit to service.

Lack of lubrication, of course, will appear in various ways up to and including a total failure. Bearings may squeal or grunt intermittently as a lubricant deficiency arises. Sometimes rubbing parts will make similar sounds, but usually can be determined by the continuity of the noise—the lack of lubrication liable to be an intermittent type, and rubbing parts liable to be more of the continuous type.

STEPS taken by a leading manufacturer of ball bearings to adjust typical complaints of customers and to provide service engineering of efficient and dependable value are outlined in the accompanying discussion, prepared by the engineering department of the Fafnir Bearing Co., New Britain, Conn.

Another familiar complaint is the operating temperature of bearing. Heat may be developed by some of the points mentioned as sources of noise. Any overload due to fit, endwise clamping—that is, where the floating bearing does not float—bent shafts, shoulders or shafts and in housings out-of-square, or misalignment to any excessive degree may cause the bearing to heat or damage itself.

In general, it should be remembered, in the case of operating temperatures, other factors alike, that the larger the bearing the higher the probable operating temperature, and the higher the bearing speed the higher the temperature. It is well to remember that, in general, roller bearings run hotter than ball bearings, double rows run hotter than single rows, angular contact bearings run at higher temperatures than radial bearings. Also, housings which do not permit radiation will run warmer than housings with generous radiation. Windage of rotating parts will make some applications run cooler than others. The amount and type of oil or grease, its consistency and amount, affect operating temperature and, of course, the larger a felt seal rubbing diameter the greater its probable effect on bearing temperature.

Temperature Estimate Possible

With a little practice, it is fairly easy to judge bearing temperatures, remembering that a housing at 100 degrees Fahr. is about body temperature. A housing on which the hand can be held for possibly 5 seconds is running about 125 degrees, and a housing on which the hand can be held for only a few seconds is probably running 150 degrees. Of course, actual determination of temperatures by means of thermometers is always preferable, not for the reason that the determination of that temperature will then and there specifically tell anything, but it will be valuable for reference and comparative purposes upon any changes made in the unit. A single temperature may not be valuable at all, but its comparison with other temperatures may be extremely valuable, actually locating causes of the difficulty as they are checked one by one.

Actual failure of bearings without question as to material or any controllable factor in the mounting generally can be identified by its widespread and continual nature. Belt tensions may be excessively high. There may be an attempt on the user's part to employ undersize belts and units in order to transmit a given amount of power, and these extra pressures and performance demand break down the bearing.

Other specific mechanical or electrical causes which have been found dangerous are excessive overhang of belts and pulleys, light shafts and the like. More than one actual case has involved electrical conditions within machinery damaging bearings before they rendered their probable useful life. Recently some large motor bearings were damaged by a live wire dropped on the shaft during installation of apparatus, and a heavy current found its way to ground through the bearing.

Dirt Is Chief Offender

Some authorities have estimated that 85 per cent of bearing failures are due to dirt. This develops for various reasons from getting a bearing dirty at installation to various conditions surrounding the design of the application and the type of service. The entrance of hard gritty particles through the seals or in a contaminated lubricant will roughen up the bearing. Any acid or impurity in grease or oil is liable to cause etching and pitting. In spite of the widespread efforts of all the ball bearing companies, operators are still careless in some cases with lubrication and protection of the bearing, both from a design and installation standpoint.

Recently, a number of large pillow blocks failed because users changed from oil to grease lubrication without adequately studying just what this difference meant. The result was that the program of lubrication did not provide for sufficient amount of grease at each lubrication and an increasing deficiency developed due to the drying nature of the atmosphere surrounding the bearing.

Vibration is particularly destructive to retainers, and in its extreme must be met with definite provisions in retainer design.

In some cases, the bearing used is of an incorrect type or size. This may range from definitely undersize bearings to bearings of a type not adapted for the actual loading conditions present in the apparatus. Ra-

(*Please turn to Page* 54)

Service Characteristics Of the Light Metals And Their Alloys

Part III

THE light metals are sufficiently resistant to corrosion so that for most applications no surface protection is required. There are times, however, when surface protection or decoration is desirable, so some of the principles involved may be of interest. It is proposed to limit this discussion of surface protection to painting, anodizing, or the artificial production of a protective oxide coating, and electroplating. Of these methods, only painting is applicable to both metals; anodizing and electroplating apply specifically to aluminum.

The principles involved in the painting of aluminum and magnesium are very much the same except for the preparation of the metal surface. The paints used on one are usually satisfactory for the other. A discussion of the procedure to be followed can conveniently be broken down into three phases; surface preparation, priming coats and finishing coats.

Blistering Causes Failures

A common type of paint failure on the light metals is blistering. This results from the liberation of gas between the metal surface and the paint film more rapidly than it can escape through the pores of the film. The formation of the gas (hydrogen) is induced by moisture penetrating the paint film and reacting with the metal. Two factors are involved, therefore: Impermeability of the film, reducing the likelihood of appreciable moisture peneration; and corrosion resistance or passivity of the metal surface. This latter factor can be controlled to a marked extent by proper surface preparation and the use of an inhibitive primer.

The surface of any metal must be free from oil, grease, and dirt prior to painting. The removal of oil and grease from both aluminum and magnesium sometimes is accomplished by the use of solvent cleaners, but more commonly by some chemical cleaner. The latter is more efficient for work on a commercial scale because the usual solvent cleaners retain the grease in solution and the subsequent evaporation of the thin film remaining on the metal after treatment again deposits a small amount of grease. In using the chemical cleaners, however, it is important that the metal be thoroughly washed and allowed to dry completely before paints are applied.

IN THE accompanying article, STEEL concludes publication of the American Society for Testing Materials' report "Service Characteristics of the Light Metals and Their Alloys" prepared recently by subcommittee VII of committee B-7 on light metals and alloys, cast and wrought. Part I appeared in the issue of Feb. 11; Part II in the issue of Feb. 18.

The chemical cleaners applicable to aluminum usually involve solutions of phosphoric acid and alcohol or those containing sodium phosphate and silicate. Numerous cleaners of these types are commercially available and are apparently very effective. The former type of solution seems to have a certain passivating effect, resulting from the formation of insoluble aluminum phosphate, in addition to its cleaning action. This passivation, while not as effective as an oxide coating (anodizing), is often quite satisfactory and less expensive.

The effectiveness of oxide coatings as a paint base on aluminum will be described here only briefly, since these coatings are more fully discussed later. The most desirable coatings are those produced electrolytically, although chemically produced coatings such as provided by immersion in a boiling solution of potassium dichromate and sodium carbonate are suitable for some applications. The Bengough process electrolytic coating, produced by anodizing in a 3 per cent chromic acid solution under specified voltage and temperature conditions, is used extensively in the aircraft industry and has been found highly satisfactory. The newer "Alumilite" process, using a sulphuric acid bath, has also been extensively tested and is recommended as quite suitable.

Methods Used in Cleaning

The surfaces of magnesium and its alloys are freed from grease and oil by means of the commercial cleaners used for aluminum, or more effectively through the use of strong alkaline cleaners, as used for steel. Parts free from grease, and containing only a thin film of oxide, require no cleaning, inasmuch as such oxide films will be removed by the chrome-pickle treatment to be referred to shortly. Heavy scale or oxide coatings are removed by washing with commercial acid cleaners or by pickling in a 1 to

Table XIII

Trade Designations of Magnesium Alloys, Cast and Wrought

Item	A.S.T.M.	U. S. Army	U. S. Navy	Dow Chemical Co. (Dowmetal)	American Magnesium Corp.	Bohn Aluminum and Brass Corp. (Bohnalite)
No. 0	[a]	57-21	.....	Magnesium		
No. 1	Alloy 1[b]	57-74-lb grade 1	M-112c alloy 1	A	AM241	X-5
No. 2	Alloy 2[b]	57-74-lb grade 2	M-112c alloy 2	G	AM240	X-2
No. 3	Alloy 3[b]	.....	.....	B	AM246	X-7
No. 4	Alloy 4[b]	.....	M-112c alloy 5	....	AM265	.....
No. 5	Alloy 5[b]	.....	M-112c alloy 3	T	.....	X-4
No. 6	Alloy 6[c,d]	.....	M-111b alloy 1	F	AM53S	X-1s
No. 7	Alloy 7[d]	.....	.....	E	.....	X-3s
No. 8	Alloy 8[d]	.....	M-126a grade 2	....	AM57S	.....
No. 9	Alloy 9[d]	.....	M-126a grade 3	....	AM58S	.....
No. 10	Alloy 10[d]	.....	M-126a grade 1	....	AM61S	X-11s
No. 11	Alloy 11[c]	.....	M-111b alloy 2	M	AM3S	.....

[a] Tentative Specifications for Magnesium Ingot and Stick for Remelting (B 92 - 33 T), *Proceedings*, Am. Soc. Testing Mats., Vol. 33, Part I, p. 636 (1933); also 1933 Book of A.S.T.M. Tentative Standards, p. 232.

[b] Tentative Specifications for Magnesium-Base Alloy Sand Castings (B 80 - 34 T), *Proceedings*, Am. Soc. Testing Mats., Vol. 34, Part I (1934); also 1934 Book of A.S.T.M. Tentative Standards.

[c] Tentative Specifications for Magnesium-Base Alloy Sheet (B 90 - 34 T), *Proceedings*, Am. Soc. Testing Mats., Vol. 34, Part I (1934); also 1934 Book of A.S.T.M. Tentative Standards.

[d] Tentative Specifications for Magnesium-Base Alloy Forgings (B 91 - 34 T), *Proceedings*, Am. Soc. Testing Mats., Vol. 34, Part I (1934); also 1934 Book of A.S.T.M. Tentative Standards.

10 per cent sulphuric acid bath. Either type of cleaning must be followed by a thorough washing and drying.

Preparation for Painting

To paint magnesium successfully, the surface of the metal must be given a chemical treatment. A number of such treatments are used commercially but the chrome-pickle (or acid-dichromate) treatment is most widely used in this country. It consists of immersing for a few minutes in a solution of sodium dichromate and nitric acid. The chrome-phosphate treatment is an alternative process and uses a solution of sodium dichromate and sodium dihydrogen phosphate but requires a longer immersion than the chrome-pickle treatment. Several other treatments are employed to some extent in Europe but their limited use in this country does not warrant their inclusion in this discussion.

In any case, the type of surface preparation to be used depends not only on the metal and character of the structure, but also on the subsequent service conditions. Although frequently considered indispensable, surface roughening by sand blasting or scratch brushing is believed somewhat overrated in so far as the light metals are concerned and is particularly to be used with caution on sheet in order to avoid warping. When used, it appears advisable to follow the roughening process by an oxide coating or chrome-pickle treatment.

Priming paints applicable to aluminum are generally suitable for magnesium and, as in the case of most metals, are probably the key to a really satisfactory paint protection. Essentially, they should be highly resistant to moisture penetration, should adhere well to the metal, should offer a good base for adherence of succeeding coats, and should contain corrosion inhibitive pigments.

Aluminum Paint a Primer

Excluding the last requirement, it has been found that aluminum paint made with a good vehicle is a suitable priming paint. Its adherence to the metal is satisfactory and it presents sufficient "tooth" for succeeding coats. For general applications, this paint can be used for both the primer and the finish coats.

Zinc chromate and certain iron oxide-zinc chromate primers made up in a long-oil varnish vehicle make excellent corrosion - inhibitive primers and are widely recommended and used. The vehicle is an important factor in determining the moisture-proofing properties of paint coatings and, for the light alloys, should be more distensible than is necessary for steel. Some of the newer snythetic resin vehicles, such as those made from bakelite and glyceral-phthalate resins, appear to be highly satisfactory. Tests have also indicated that blue lead and red lead primers can be used, but that they are generally inferior to the aluminum paint and the inhibitive primers, especially where seams and joints are encountered.

Once the metal is properly primed, any durable exterior paint or enamel may be employed for finishing coats. Here again, material long in oil is especially recommended; any desired color can be applied. When the color of natural aluminum is satisfactory, aluminum paint is frequently used. This paint has been found to give excellent protection to both aluminum and magnesium products under numerous exposure conditions.

The synthetic-resin and the lacquer enamels have also been found to offer excellent protection, particularly if a very elastic type is used. The synthetic-resin finishes are especially recommended both for protection and high-grade finishing. The lacquers are a little less effective than the synthetic resins on account of the tendency toward brittleness.

Using an Inhibitive Primer

Good protection against severely corrosive conditions is secured by a schedule comprising one coat of an inhibitive primer and two coats of aluminum paint; all made up with a good vehicle. Generally speaking, a good paint coating may show about twice the durability on aluminum and magnesium as on steel.

Clear finishes are sometimes desirable for the protection of polished surfaces or various colored finishes. These coatings may be either the lacquer or varnish types, but must be distensible and resistant to sunlight. Pyroxylin lacquers ordinarily lack this characteristic, although some of these lacquers which have been recently developed appear satisfactory. Varnishes of the modified glycerol-phthalate type generally show greater durability than the lacquers and adhere to the metal surface excellently. Certain vinyl resin varnishes have also given satisfactory results, but ordinary varnishes tend to yellow and are usually unsatisfactory. Coatings of a good wax are also sometimes used for structures subject to frequent maintenance, since they are readily removed and easily replaced.

Baked finishes are frequently used

Table XIV

Trade Designations of Aluminum Wrought Alloys

Item	A.S.T.M.	S.A.E.	U. S. Army	U. S. Navy[c]	Federal Specifications Board	Aluminum Company of America	The Nicralumin Co. (Nicral)	Apex Smelting Co.
No. 1	[a]	No. 78 (25)	57-151-1	47A2a	QQ-A-561	2S	.....	....
				46A3b	QQ-A-411	.....	.....	....
				44T19	WW-T-783	.....	.....	....
No. 2	[b]	No. 29	.....	47A4c	QQ-A-359	3S	.....	....
				46A6a	QQ-A-356	.....	.....	....
				44T20a	WW-T-788	.....	.....	....
				47A7	.....	.....	.....	....
No. 3	.....	.....	Air corps 11069	44T24	.....	4S	.....	....
				47A9				
				46A8				
No. 4	.....	.....	.....	.....	.....	14S	.....	....
No. 5	[c]	No. 26	57-153	47A3a	QQ-A-355	17S	.....	....
	[d]	.....	.....	46A4b	QQ-A-351	.....	.....	....
	.....	.....	57-187-2	47T21	WW-T-786	.....	.....	....
	.....	.....	57-152-2	47A6a	.....	Alclad 17S	.....	....
				46A46				
				44T21a				
				44T22				
				46A7a				
				43R5				
				43B13				
No. 6	.....	.....	.....	....	.....	A 17S	.....	....
No. 7	.....	.....	.....	....	.....	B 17S	.....	....
No. 8	.....	.....	.....	....	.....	C 17S	.....	....
No. 9	.....	.....	.....	.....	.....	18S	.....	....
No. 10	.....	No. 24	Air corps 11066	47A10	.....	24S	.....	....
			Air corps 11067 and 11071	47A8	.....	Alclad 24S	.....	....
No. 11	.....	No. 27	57-153	46A7a	.....	25S	.....	....
No. 12	.....	.....	.....	....	.....	32S	.....	....
No. 13	.....	No. 28	.....	....	.....	51S	.....	....
No. 14	.....	.....	.....	....	.....	53S	.....	....
No. 15	.....	.....	.....	....	.....	70S	.....	....
No. 16	.....	.....	.....	....	.....	.....	.....	400
No. 17	.....	.....	.....	....	.....	.....	A	
No. 18	.....	.....	.....	....	.....	.....	B	
No. 19	.....	.....	.....	....	.....	.....	X	

[a] Tentative Specifications for Aluminum Sheet and Plate (B 25 – 33 T), *Proceedings*, Am. Soc. Testing Mats., Vol. 33, Part I, p. 605 (1933); also 1933 Book of A.S.T.M. Tentative Standards, p. 199.

[b] Tentative Specifications for Aluminum-Manganese Alloy Sheet and Plate (B 79 – 33 T), *Proceedings*, Am. Soc. Testing Mats., Vol. 33, Part I, p. 614 (1933); also 1933 Book of A.S.T.M. Tentative Standards, p. 208.

[c] Tentative Specifications for Aluminum-Alloy (Duralumin) Sheet and Plate (Aluminum-Copper-Magnesium-Manganese) (B 78 – 33 T), *Proceedings*, Am. Soc. Testing Mats., Vol. 33, Part I, p. 610 (1933); also 1933 Book of A.S.T.M. Tentative Standards, p. 204.

[d] Tentative Specifications for Aluminum-Alloy (Duralumin) Bars, Rods and Shapes (Aluminum-Copper-Magnesium-Manganese) (B 89 – 33 T), *Proceedings*, Am. Soc. Testing Mats., Vol. 33, Part I, p. 600 (1933); also 1933 Book of A.S.T.M. Tentative Standards, p. 194.

[e] In addition to the specifications listed, several Navy Bureaus have tentative specifications.

on the light metals and are considered very suitable on magnesium articles as they combine speed of finishing with excellent film characteristics. Those requiring high baking temperatures, however, should be used with discretion as they may result in undesirable precipitation hardening in certain alloys. A finish baked at lower temperatures can be used in such cases. In all cases, baking time should be as short as possible.

In all light-metal assemblies, the concealed or faying surfaces should be sealed or water proofed with some good protective paint and the design should avoid conditions promoting the retention of moisture. Faying surfaces between the light metal and any dissimilar metal, or wood, should, particularly, be insulated with a good paint. For this work the bituminous-base paints or asphaltic sealing compounds are used frequently, where their color is not objectionable, for their high moisture-proofing efficiency. Since these paints may bleed through subsequent coats, it is generally advisable to remove any excess that may be squeezed out of the joints. Where color is of importance, the bituminous paints may be pigmented with aluminum powder or aluminum paint used instead. Reinforced red lead is highly recommended as an insulating paint for magnesium but has not been found particularly desirable for aluminum.

Producing Oxide Coatings

Aluminum always carries a thin, natural oxide coating which, without doubt, is responsible for the corrosion resistance of the metal. This natural coating, although thin, is quite impermeable and highly protective. Oxide coatings of substantial thicknesses can be artificially produced on aluminum by both chemical and electrochemical or electrolytic methods. The electrolytic or anodic coatings have proved very useful for many commercial applications.

The three generally-used methods for producing electrochemical coatings are primarily differentiated by the electrolytes used—chromic acid, sulphuric acid and oxalic acid. Otherwise, the processes are similar, in that the article to be coated is made anode in a bath of specified composition and at a closely controlled temperature.

In the formation of the oxide coating electrolytically, the action takes place at the interface between the metal and the oxide already formed. Theoretically, then, it is possible to form coatings of unlimited thickness, provided the coating remains permeable to the electrolyte and permits the current to flow. Practically, however, the electrolytes have some solvent action on the oxide and the thickness is limited by chemical solution of the oxide. Nevertheless, coatings several mils in thickness can be produced; but those used commercially are generally less than one mil in thickness.

The chromic and sulphuric acid processes are most widely used in this country. They both produce coatings which provide an excellent base for paint as well as offering reasonably good protection in themselves. The sulphuric acid coating, however, is less expensive to apply, is generally thicker, and is more resistant to abrasion.

Sealing Anodic Coatings

X-ray evidence indicates that the anodic coatings are an amorphous form of aluminum oxide and, as formed, are somewhat porous and adsorptive. They can be treated by certain so-called "sealing" methods to change the structure and reduce this porosity with a consequent increase in impermeability and protective qualities. The porous coatings will adsorb certain types of dyes, mineral pigments, or corrosion inhibitors, greatly extending their useful properties. This adsorbing power may be varied, of course, with the coating methods used.

Until recently the coating applied in chromic acid has been used extensively in the aircraft industry as a base for paint, although now being superseded in many cases by coatings applied in sulphuric acid and sealed with common inhibitors. This latter process provides improved corrosion resistance with added abrasion resistance, and may be used equally well for surface protection and various color effects. The coatings have good dielectric properties and appear to have promise for use in electrical insulation, particularly where weight and space saving are desirable, or resistance to relatively high temperatures is of interest.

Aluminum can be readily electroplated with the common coating metals provided that the proper procedures are followed and some care in the choice of the base alloy and coating metal is exercised. Zinc and chromium can be plated directly on aluminum to produce a coating quite resistant to certain corrosive conditions while nickel followed by some other metal will produce a decorative coating which will resist abrasion and eliminate smudging. These duplex coatings, like most decorative coatings on other metals, are generally not very resistant to severe corrosion.

The proper preparation of the surface is probably the most important

Table XV

Foundry Characteristics of Aluminum Casting Alloys

Item	Type: Sand Casting Alloy	Type: Permanent Mold Casting Alloy	Standard Condition Heat Treatment: As Cast	Standard Condition Heat Treatment: Solution Heat Treatment	Standard Condition Heat Treatment: Precipitation Treatment	Solidification Range: deg. Fahr.	Solidification Range: deg. Cent.	Fluidity[a]	Hot Shortness[a]	Welding[a]	Soldering[a]	Machining[a]	Ease of Polishing[a]	High Temperature Properties[a]	Leakproof Properties[a]	Corrosion Properties[a]
Sand and Permanent Mold																
No. 1	x	x	x			1175-1005	635-540	4	6	3	4	5	3	3	4	7
No. 2	x		x			1140-	615-	3	6	6	7	3	5	7	4	8
No. 3	x		x					3	6	6	7	3	5	7	4	8
No. 4	x	x	x			1175-1005	635-540	4	5	3	5	5	3	3	4	7
No. 5	x	x	x			1175-1005	635-540	4	5	3	4	5	3	3	4	8
No. 6	x		x			1160-1005	625-540	3	5	4	5	4	3	2	2	7
No. 7	x	x		x	x	1160-1004	625-540	3	5	3	4	4	3	2	5	7
No. 8	x			x	x	1195-1020	645-550	5	8	4	3	6	3	5	5	5
No. 10	x	x	x	x	x	1165- 995	630-535	5	6	4	4	4	3	2	6	6
No. 11	x	x	x			1165-1070	630-575	1	1	1	8	9	6	5	1	2
No. 12	x		x			1150-1070	620-575	1	1	1	8	9	6	3	2	2
No. 13	x		x			1185-1075	640-580	6	2	10	7	4	2	1	8	1
No. 14	x	x		x	x	1095-1000	590-540	1	1	2	8	9[b]	7	2	2	3
No. 15	x	x		x	x	1160-1075	625-580	1	1	1	8	7	6	3	1	3
No. 16	x			x	x	1130-1075	610-580	1	1	1	8	7	6	5	1	2
No. 17	x			x		1150- 840	620-450	6	2	10	7	2	4	1	8	1
Die-Casting Alloys																
No. 11						1165-1070	630-575	2	2	1	..	7	5	..	1	2
No. 12						1150-1070	620-575	1	1	2	..	8	5	..	1	1
No. 18						1165-1050	630-565	5	3	3	..	5	4	..	5	5
No. 19						1150-1025	620-550	3	3	4	..	4	4	..	3	5
No. 20						1200-1125	650-605	5	3	5	..	3	2	..	6	4
No. 21						1200-1100	650-595	4	4	5	..	2	2	..	4	4
No. 22						1150-1025	620-550	3	3	3	..	2	3	..	3	6

[a] Rated 1 for Excellent and 10 for Poor. Intermediate ratings are relative order of merit in each case and based on only alloys listed. Die castings classified separately.
[b] With carboloy tools rated as 3.

prerequisite to a satisfactory electroplate on aluminum. In this, the procedure varies to some extent with the alloy, product and proposed coating. Essentially, it consists of an alkaline cleaning, and acid dip, and a surface-roughing treatment.

Cleaning for Electroplating

The alkaline cleaning, considered more satisfactory than solvent cleaning, removes grease and oil and is usually carried out in a hot solution of sodium carbonate and trisodium phosphate. This cleaning is followed by a cold water rinse and a dip in hydrofluoric or nitric plus hydrofluoric acid. When only a small amount of grease, such as from finger marks, is on the surface, the alkaline cleaning may sometimes be omitted and only the acid dip used.

The metal surface, after these cleaning treatments, is generally considered "smooth" and apparently can be satisfactorily plated only with zinc or chromium. Either of these metals can be deposited on the "smooth" aluminum from ordinary plating solutions and will result in adherent coatings. The chromium deposit will come from the bath a dull gray color but, if produced in a cold (80 degrees Fahr.) solution, can be easily buffed and will effectively resist alkaline corrosion. The zinc deposit, from a cyanide bath, is also resistant to corrosion unless subsequently covered with another metal, such as copper or nickel.

For general use it is customary to apply first a layer of nickel and then the desired finish coat. In order to secure proper adherence of the plating a special surface-roughening treatment must first be employed. This roughening must be of a nature that will produce irregularities or pits having an undercut shape rather than merely an irregular surface as produced by sand blasting. Special etching solutions, which selectively dissolve certain constituents, have been developed for this purpose. They vary, of course, with the alloy and its form, but are essentially acid solutions with or without added metal salts. The time of dip varies to some extent and should be determined by testing the adherence of subsequently plated samples for different dipping times.

Choice of Plating Materials

Plating on the roughened surface can be done from many different commercial baths. Nickel deposits from baths containing nickel sulphate, ammonium chloride, boric acid and either sodium or magnesium sulphate are highly satisfactory. These baths produce good deposits which can be readily buffed to a high luster. For moderate, outdoor service, a coating of 0.0005 to 0.001-inch is recommended. Chromium, copper, brass, silver, and many other metals may be deposited over a nickel plate from the usually-used baths. Acid baths are preferable to cyanide baths for these final coatings since the latter tend to a certain extent to undermine the plating of nickel previously applied.

Table XVI

Trade Designations of Aluminum Casting Alloys

Item	A.S.T.M.	S.A.E.	U. S. Army	U. S. Navy	Aluminum Company of America	Stewart Die Casting Corp.
No. 1	.....	No. 30	57-72 grade 5	.....	No. 12	.....
No. 2	.....	No. 31	.....	.....	.....	.....
No. 3	.....	No. 31A	57-72 grade 8	.....	No. 645	.....
No. 4	Grade B[a]	No. 36	.....	.....	No. 212	.....
No. 5	Grade C[a]	No. 33	57-72 grade 7	.....	No. 112	.....
No. 6	Grade E[a]	No. 32	.....	.....	No. 109	.....
No. 7	Grade F[a]	No. 34	57-72 grade 6	.....	No. 122	.....
No. 8	Grade G[a]	No. 38	57-72-5	46A1c class 4	No. 195	.....
No. 9	Grade GG[a]	.....	.....	.....	No. 196	.....
No. 10	Grade H[a]	No. 39	57-72-1A	.....	No. 142	.....
No. 11	Grade J[a]	No. 35	57-72 grade 1	46A1c class 2	No. 43	.....
	No. IV[b]	No. 304	57-93-1	.....	No. 43	No. 35
No. 12	Grade K[a]	No. 37	.....	.....	No. 47	.....
	No. V[b]	No. 305	.....	.....	No. 13	No. 13
No. 13	.....	No. 320	57-74-4	.....	No. 214	.....
No. 14	.....	No. 321	.....	.....	No. 132	.....
No. 15	.....	No. 322	Air Corps 11307	.....	No. 355	.....
No. 16	.....	No. 323	Air Corps 11308	46A1c class 3	No. 356	.....
No. 17	.....	No. 324	.....	.....	No. 220	.....
No. 18	No. VI[b]	.....	.....	.....	No. 83	.....
No. 19	No. VII[b]	No. 307	.....	.....	No. 85	No. 10
No. 20	No. VIII[b]	.....	.....	.....	.....	.....
No. 21	No. IX[b]	No. 309	.....	.....	No. 93	No. 5
No. 22	No. XII[b]	No. 312	57-93	.....	No. 81	No. 12

[a] Classified according to the Tentative Specifications for Aluminum-Base Alloy Sand Castings (B 26 - 33 T), *Proceedings*, Am. Soc. Testing Mats., Vol. 33, Part I, p. 595 (1933); also 1933 Book of A.S.T.M. Tentative Standards, p. 189.

[b] Classified according to the Tentative Specifications for Aluminum-Base Alloy Die Castings (B 85 - 33 T), *Proceedings*, Am. Soc. Testing Mats., Vol. 33, Part I, p. 641 (1933); also 1933 Book of A.S.T.M. Tentative Standards, p. 254.

Purchasing Agents Adopt Steel Bar Color Marking

A color code for marking steel in bars—flat, oval, hexagon, round and square—has been adopted by the National Association of Purchasing Agents. The code was developed by the association's iron and steel committee on the basis of the Society of Automotive Engineers' designation by number of the well-known kinds of steel.

The code gives color markings for S.A.E. carbon, screw stock, nickel, nickel-chromium, molybdenum, chromium, chromium-vanadium, silico-manganese and tungsten steels, and for staybolt steel. According to a statement made by the Purchasing Agents' association, the color code has been made part of the federal standard stock catalog and is mandatory in all departments of the government.

Some years, the suggestion was made to the American Standards association that it would be desirable to develop a national standard system of marking steel bars. This association canvassed a considerable number of organizations manufacturing or using steel bars, and found little enthusiasm for the proposed project. In the meantime, the Purchasing Agents' organization has found it possible to develop a color code for use by its own members which also has found recognition outside that association. Thus the chances for successfully developing an American standard code now appear brighter.

Holds Patents on Surface Hardening Process

To the Editor:

We were very much pleased to note the paper by John Wyzalek, metallurgist, Hyatt Bearings division of the General Motors Corp., on carburizing which appeared in STEEL for Feb. 4, page 31.

Among other things, we were much interested to note his reference to the new method of surface hardening, "Ni-Carb." This is a trade name which we have coined and the process by which this finish is obtained is covered by a process patent, the claims for which have been allowed to A. W. Machlet, president of the American Gas Furnace Co.

It occurred to us that this information might be of interest to your readers.

P. C. OSTERMAN,
American Gas Furnace Co.,
Elizabeth, N. J.

METHODS AND MATERIALS

Care Will Reduce Breakage Of Grinding Wheels

Users of grinding wheels should have available a copy of the safety standards or code for the use, care and protection of wheels. Not only should it be available, but also some one man who is familiar with the various rules given in the safety code should be placed in charge of the grinding department to see that they are followed.

The value of such an arrangement can be illustrated by two specific examples. In one plant, trouble was experienced with wheels cracking, and investigation showed that the flanges used in mounting the wheels were flat instead of recessed as specified in the safety code. Evidentally the original flanges were lost or a change in wheel size made it necessary to have larger ones, so new ones were made without knowledge of the desirability of recessing.

In another plant, similar difficulty was experienced with saucer-shaped wheels employed in sharpening cutters. Examination of the wheels indicated that one of the flanges was correct in size, and the other was much smaller. Check up of the grinding machine revealed that one of the flanges had been replaced by an ordinary flat washer when through carelessness it had been lost. As may be surmised, trouble in both cases could have been eliminated through knowledge and enforcement of safety code regulations.

S S S

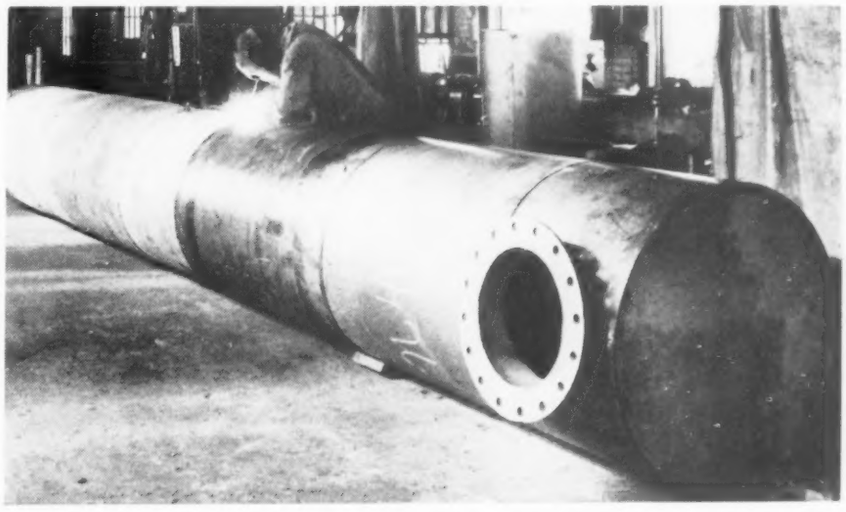
More Nickel Alloys Being Used in Oil Industry

In the oil industry, the increasing depths to which driling is being carried, the introduction of new refining processes, and the trend toward more economical distribution have all opened new markets for nickel alloys. Especially noticeable in 1934 was the widespread adoption of nickel alloy steels in production equipment. The more stringent requirements of modern drilling equipment, with wells as deep as 10,000 feet, are reflected in the increased amount of nickel alloy steel used in the oil fields. Monel metal also has won recognition in production equipment for handling and cleaning the drill mud.

A notable development has been the nickel-alloyed wrought iron sucker rod. Being in contact with underground saline waters containing sulphur, sucker rods fail from corrosion-fatigue, and therefore require a material which will have both strength and corrosion-resistance to a high degree. Sucker rods of wrought iron containing 3.5 per cent nickel have shown themselves greatly superior to those of ordinary carbon steel, and their use in expanding rapidly (STEEL, Feb. 18, p. 50).

In the refinery, the most important development of 1934 was the adoption of welded nickel steel for pressure vessels used in the dewaxing process. The extremely low temperatures encountered in this process, down to 75 degrees below zero, embrittled ordinary steels, but it was found that nickel steels retain their strength and toughness. From the installations made during the year, and interest shown by other companies, it would seem that an im-

Welded Steel Muffler



MAXIM SILENCER FOR DIESEL ENGINE: Muffling the exhaust of powerful diesel engines calls for ingenuity in the construction of large silencers. Maxim Silencer Co., Hartford, Conn., fabricates a wide range of sizes, from 1 to 30 feet in length, 6 to 60 inches in diameter and 25 to 10,000 pounds in weight, using arc welded steel construction. Steel varies from 20-gage to ¼-inch in thickness. In addition to the slight back pressure involved in muffling exhaust gases, silencers must be built to withstand occasional explosion of unburned gases. Most of the welded joints are of butt and lap type, similar to the practice in tank work; however, in smaller cylinders, edge welds are used. Welding machines and electrodes are supplied by Lincoln Electric Co., Cleveland

portant field for nickel steels has opened up. Among other outstanding uses for nickel alloys in refineries are nickel-aluminum-bronze condenser tubes and nickel cast iron bubble caps for fractionating towers.

s s s

Tin Beer Containers Lined With Special Material

According to recent reports, a Virginia brewery is now distributing its product in "keglined" tin containers developed by the American Can Co., New York. The inside of this new type container is lined with a protective patented surface, similar to that used on the inside of beer barrels. The same company also is reported to have introduced a special type of composition container for distribution of milk. The latter is being used by certain New Jersey milk distributors.

s s s

Chrome-Molybdenum Cast Steel Suitable for Valves

A 5 per cent chrome-molybdenum cast steel fills the need for an economical corrosion-resisting steel for valve bodies and fittings for cracking service handling corrosive oils. Stainless steels of the 12 per cent chromium analyses are practically immune to corrosion of hot oils, but offer considerable difficulties both in the making of intricate castings and machinability, making their initial cost quite high. Tests on steels with lesser amounts of chromium have shown that cast steels with 4½ to 6½ per cent chromium conservatively offer from five to ten times the resistance to corrosion of carbon steel.

The addition of 0.5 per cent molybdenum, besides aiding the corrosion resistance, also enhances the service life due to the fact that it inhibits brittleness, common to the plain chromium steels. While this steel was developed primarily for its corrosion resistance, high temperature test data show flanged valves and fittings designed for nominal pressures at 750 degrees Fahr. may be safely recommended for the same pressures at temperatures 200 to 250 degrees higher.

s s s

Repairs Cast Iron Foundry Flasks by Welding

A furnace manufacturer encounters considerable breakage of cast iron flasks in its foundry because of rough handling. The company's welding operator has devised a way to repair these broken flasks by clamping a piece of mild steel strap of sufficient length and thickness over the break and arc welding it fast with a good cast-iron electrode. The welding operator finds it is not necessary to pause to allow for contraction because the steel will stretch. Welding current is about 125 amperes.

s s s

Forms Oxide on Aluminum By Artificial Means

A protective oxide, similar to that formed on aluminum by natural processes when the surface comes in contact with the air, but many times thicker, may be obtained by artificial means. Metal to be treated is placed in a sulphuric acid bath of special composition through which a current is passed. The oxide coating is ordinarly transiucent and does not conceal the natural metallic luster of the metal. Coatings produced may be highly resistant to corrosion and abrasion.

Sprayed Metal Coatings Provide Means For Improving Surface Qualities

IN THE sprayed molten metal coating process, the coatings are applied by a self-contained, portable spray gun. This hand tool melts, atomizes and sprays commercial metals to form coatings on surfaces of any size and shape and of practically any material. Thus, the process may be said to carry out regular foundry practice of melting and pouring metals. The molten metal is in fine particles, however, and is "poured" by a jet of compressed air on the surface to be coated. This method gives unique control of results and is able to meet and satisfy industrial requirements.

E. V. David, applied engineering department, Air Reduction Sales Co., New York, points out that the metal to be sprayed is supplied to the gun in the form of wire, of standard Brown & Sharpe gage. The coating may be built up to almost any desired thickness on any surface, whether metallic, fibrous, vitreous, conducting, insulating or inflammable and may be adherent or separable. Application may be made before, during or after fabrication of the part, either in the shop or in the field. The process uses no pigments, solvents, fluxes or other vehicles.

High melting temperature metals may be sprayed on base metals or on previously applied coatings having low melting temperatures. Alternate layers of as many different metals as desired, ferrous or nonferrous, may be applied, one on top of the other.

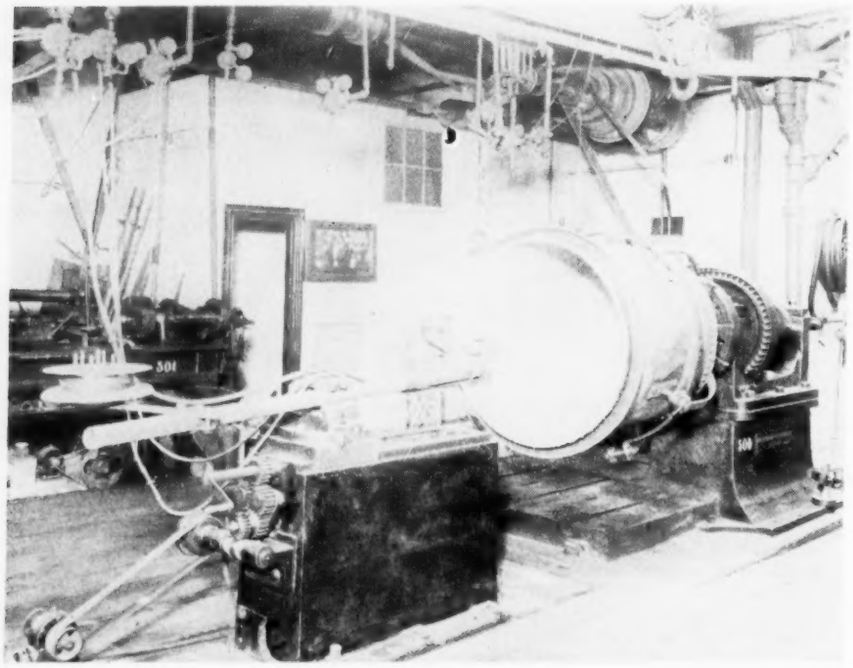


Fig. 1—Spraying tin on the inside of a large jacketed copper cooking kettle, the latter mounted in the headstock of a lathe and rotated while the metal spraying unit feeds in and out

The sprayed metal applied is almost instantly cold, hard and ready for use. Small oxyacetylene flames are used to melt the wire in the spray nozzle of the gun.

Sprayed molten metal coatings are employed for a variety of purposes, such as for corrosion resistance, heat resistance, building up worn or poorly machined parts, repairing surface defects, decoration and art work, electric current conductance and mass coating small parts in tumbling barrels.

Work Mounted in Lathe

A typical example of a sprayed molten metal coating to resist corrosion is illustrated in Fig. 1, which shows the application of tin 0.010-inch thick to the inside of a large jacketed copper cooking kettle. The kettle is being rotated in the headstock of a large lathe, while the metal spraying device is mounted on a long bar attached to a machine for feeding it in or out of the kettle as the latter rotates.

Fig. 2 shows some examples of heat-resistant sprayed molten metal coatings. The locomotive grate bars and arch tubes shown have been "alumetized." In this process the parts are coated with sprayed molten aluminum in the usual manner, to a thickness of about 0.008 to 0.010-inch. They are then painted with three successive dip or brush coats of potassium silicate and placed in a heat treating furnace at 1400 degrees Fahr. for 5 minutes. The temperature of the furnace then is raised to 1900 degrees Fahr. and the parts allowed to soak for a further period, depending on their size and shape. This heat treatment produces a ferro-aluminum alloy, penetrating to a considerable depth beneath the coated surface, with a top surface of aluminum oxide. It is exceptionally effective in preventing scaling from heat and greatly increases the life of such iron and steel parts. In cooling, the potassium silicate cracks off, but its function has been performed in the heat treating operation.

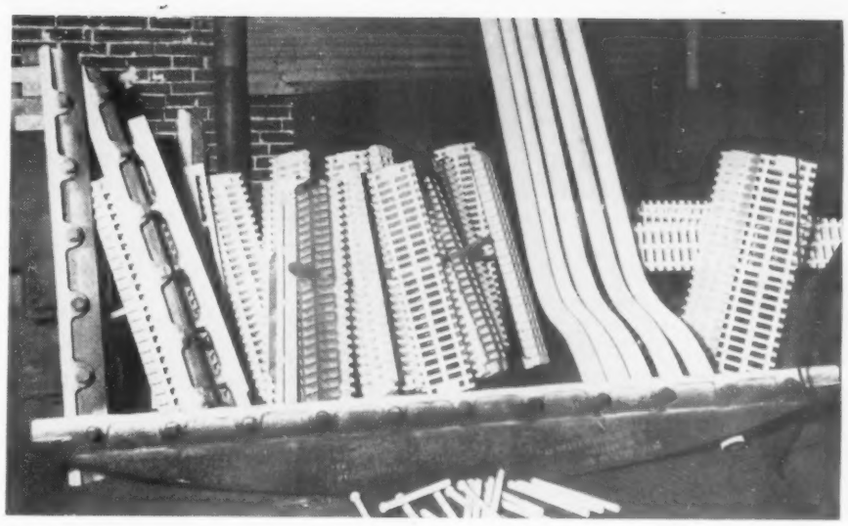


Fig. 2—Samples of heat-resistant sprayed molten metal coatings. Locomotive grate bars and arch tubes shown have been alumetized—sprayed with molten aluminum and heat treated to produce a surface alloy of ferroaluminum

Supply Parts for "Flying Yankee"

MATERIALS and parts for the New Flying Yankee, diesel-electric, streamlined, articulated, stainless steel train, built by Edward G. Budd Mfg. Co., Philadelphia, for the Boston & Maine and Maine Central railroads, and described on Pages 55 and 56 of STEEL of Feb. 11, were furnished by 108 companies, as follows:

Builder—Edward G. Budd Mfg. Co., Philadelphia.

Power plant—Winton Engine Co., Cleveland.

Stainless steel—Allegheny Steel Co., Brackenridge, Pa.; American Sheet & Tin Plate Co., Pittsburgh; American Steel & Wire Co., Chicago; Eastern Rolling Mill Co., Baltimore; Rustless Iron Corp. of America, New York; Sharon Steel Hoop Co., Sharon, Pa.; Superior Steel Corp., Pittsburgh.

Engine-bed assembly, rear bolster and needle beams—Lukenweld Inc., Division of Lukens Steel Co., Coatesville, Pa.

Forgings—Camden Forge Co., Camden, N. J.

Springs—Atlantic Spring & Mfg. Co., Philadelphia.

Motor suspension springs—American Locomotive Co., Railway Steel-Spring Division, New York.

Truck coil and elliptic springs and clasp brakes—American Steel Foundries, Chicago.

Equalizer springs, Helical-volute—Holland Co., Chicago.

Truck castings, steel—General Steel Castings Corp., Eddystone, Pa.

Side bearings—A. Stucki Co., Pittsburgh; Amplex Mfg. Co., Detroit.

"Compo" bearings—Bound Brook Oil-Less Bearing Co., Bound Brook, N. J.

Hand brakes—National Brake Co., Buffalo.

Air-brake equipment—New York Air Brake Co., New York.

Brake shoes—American Brake Shoe & Foundry Co., New York.

Brake lining—Raybestos-Manhattan Inc., Passaic, N. J.

Roller-bearing journal boxes—Hyatt Roller Bearing Co., Newark, N. J.

Valves—National Pneumatic Co., New York.

Wheels and axles—Bethlehem Steel Co., Bethlehem, Pa.

Couplers—McConway & Torley Corp., Pittsburgh.

Heating system—Vapor Car Heating Co., Chicago.

Air-conditioning equipment—Frigidaire Corp., Dayton, O.

V-belt drives—Dayton Rubber Mfg. Co., Dayton, O.

Grilles—Tuttle & Bailey Mfg. Co., New Britain, Conn.

Air compressor—Gardner-Denver Co., Quincy, Ill.

Electric power equipment—generator, control, traction motors, panels—General Electric Co., Schenectady, N. Y.

Radiator system—Harrison Radiator Corp., Lockport, N. Y.

Electrical supplies—General Electric Co., Schenectady, N. Y.; Graybar Electric Co., New York; Pyle-National Co., Chicago.

Batteries—Electric Storage Battery Co., Philadelphia.

Head and tail light—Electric Service Supplies Co., Philadelphia.

Lighting fixtures—Safety Car Heating & Lighting Co., New York.

Uniletes and steel conduit—Appleton Electric Co., Chicago.

Wire and cable—Okonite Co., New York.

Shock absorbers—Houdaille Hershey Corp., Buffalo.

Rubber products—Continental Rubber Works, Erie, Pa.; Dryden Rubber Co., Chicago; Fabreeka Products Co. Inc., Boston; B. F. Goodrich Rubber Co., Akron, O.; Goodyear Tire & Rubber Co., Akron, O.; Quaker City Rubber Co., Philadelphia.

Oil cups—Casanave Supply Co., Philadelphia.

Speed recorder—Weston Electrical Instrument Co., Newark, N. J.

Sander equipment—Graham-White Sander Corp., Roanoke, Va.

Horn—Leslie Co. Inc., Lyndhurst, N. J.

Fire extinguisher—Pyrene Mfg. Co., Newark, N. J.

Calking compound—Ev-Air-Tight Calking Co., Philadelphia.

Felt—Fidelity Felt Co., Philadelphia.

Reefer felting—Geo. A. Nicol Corp., New York.

Weatherstripping—Midgley & Borrowdale, Chicago.

Burlap—R. A. Humphrys' Sons, Philadelphia.

Insulation—Celotex Co., Chicago; Johns Manville, New York; Keasbey & Mattison Co., Ambler, Pa.

Asbestos board—Norristown Magnesia & Asbestos Co., Norristown, Pa.

Cork—Armstrong Cork Products Co., Lancaster, Pa.

Tape—L. H. Gilmer Co., Philadelphia.

"Presdwood"—Masonite Corp., Chicago.

Deadlight panel assemblies—United States Plywood Co. Inc., New York.

Agasote ceiling lining—Pantasote Co. Inc., New York.

Paints—Barrett Co., New York; Gilbert Spruance Co., Philadelphia.

Larcoloid enamel—Larkin Co. Inc., Buffalo, N. Y.

Primer, sizing, cement—Dolphin Paint & Varnish Co., Toledo, O.

Window sash—O. M. Edwards Co., Syracuse, N. Y.

Window glass—Pittsburgh Plate

Glass Co., Pittsburgh.

Windshield wipers—Trico Products Co., Buffalo.

Wire mesh—Buffalo Iron Works, Buffalo.

Wire cloth—Newark Wire Cloth Co., Newark, N. J.

Roller curtains—Railway Curtain Co., Chicago.

Curtain rods and fixtures—Kirsch Co., Sturgis, Mich.

Drapery material—Bassett & McNab Co., Philadelphia.

Furniture—Charles Gerlach, Philadelphia.

Seats—Sterling Fibre Co., Waltham, Mass.

Seat covering—Massachusetts Mohair Plush Co., Boston.

Lounge chairs—S. Karpen & Bros., Chicago.

Etching—Regal Art Glass & Fixture Co., New York.

Basket Racks—Rostand Mfg. Co., Millford, Conn.

Carpet—Bigelow-Sanford Carpet Co., New York.

Flooring—United Cork Companies, Lyndhurst, N. J.

Buffet service equipment—Angelo Colonna, Philadelphia.

Buffet tops—Formica Insulation Co., Cincinnati.

Trays—Aluminum Cooking Utensil Co., New Kensington, Pa.

Cooking utensils—Edison General Electric Appliance Co., Chicago.

Diaphragms—Morton Mfg. Co., Chicago.

Safety floor plates, steps and cat walk—Alan Wood Steel Co., Conshohocken, Pa.

Door hangers and tracks—Richards-Wilcox Mfg. Co., Aurora, Ill.

Chains, hardware—American Chain Co., Bridgeport, Conn.

Hardware—American Car & Foundry Co., New York; The Homer D. Bronson Co., Beacon Falls, Conn.; Russell & Erwin Mfg. Co., New Britain, Conn.

Hinges, outside doors, ball bearing—Stanley Works, New Britain, Conn.

Safety chains—Bradlee & Co. Inc., Philadelphia.

Piping—Kerotest Mfg. Co., Pittsburgh.

Metal tubing—Titeflex Metal Hose Co., Newark, N. J.

Copper tubing and piping—Chase Brass & Copper Co., Waterbury, Conn.

Water coolers, cup receptacles—Henry Giessel Co., Chicago.

Steel tanks—John Wood Mfg. Co., Conshohocken, Pa.

Toilets—Dayton Mfg. Co., Dayton, O.

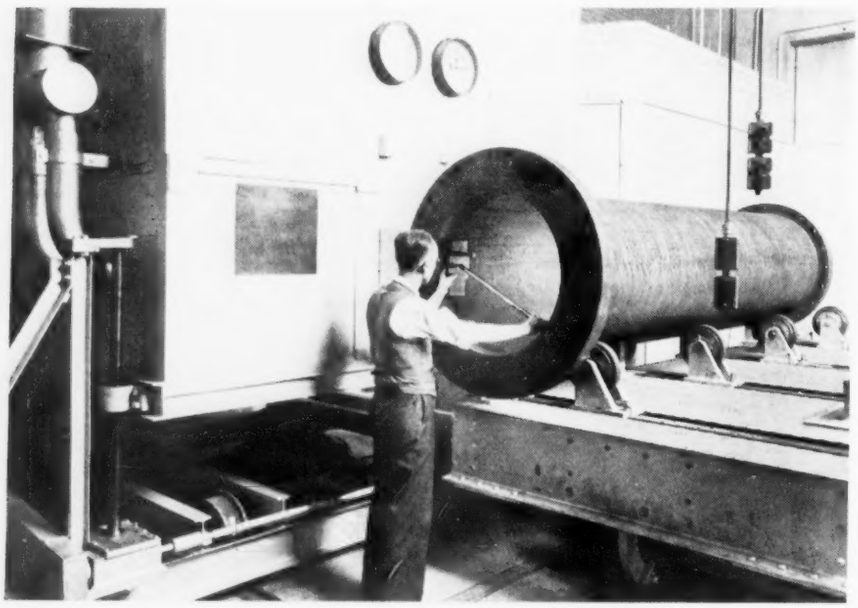
Toilet paper boxes—Northern Paper Mills, Green Bay, Wis.

X-Ray Inspection Speeded By Storage Battery Truck

To reduce time required in X-ray examination of welded steel heat exchanger shells, Westinghouse Electric & Mfg. Co. has equipped the new X-ray laboratory at its South Philadelphia, Pa., plant with an electric storage battery truck running on tracks at right angles to the X-ray cabinet. It has a forward speed up to 20 feet per minute. On the truck are mounted two rows of rubber covered wheels for supporting the heat exchanger cylinders. One row is motor driven by power from the same battery that actuates the truck, so that the cylinder easily may be rotated for location within the X-ray tube focus (see illustration below).

The equipment is installed in a 25 x 45-foot room, walls and doors of which are lined with lead $\frac{1}{4}$-inch thick. The opening of any door into the X-ray room instantly shuts down the equipment. These safeguards protect the workmen against injury by X-rays.

The axis of the X-ray tube and the cylinder on the truck must be in the same horizontal plane. Therefore, the entire X-ray cabinet is mounted on screws and can be raised or lowered as necessary. A motor drive moves the cabinet to and from the piece under examination. Control of all movements of the cabinet and X-ray tube is by means of push buttons on the truck.



Welded steel heat exchanger unit mounted on storage battery truck for X-ray examination. This view shows the method of setting the cassette by means of a telescope rod pointed at both ends; an enclosed spring exerts sufficient pressure to hold the cassette firmly in position. Focal gage, elevator gage and copper plate with index numbers, used in adjusting the X-ray cabinet, are visible from the truck platform. All operations are controlled from the truck platform

Develops Gas-Operated Air Conditioning Apparatus

Introduction of a gas-operated summer air conditioner for homes, commercial structures and industrial plants, announced by the industrial gas research committee of the American Gas association, marks another new use for gas fuel.

The unit differs from any other summer air conditioning apparatus now available. Commercial production is being handled by the Bryant Heater Co., Cleveland. Sales engineering schools will be started immediately in seven cities actively to promote installations.

Entrance of the gas industry in the air conditioning field is the result of six years of research and experimental testing promoted by the entire gas industry and directed by the industrial gas research committee, of which F. J. Rutledge, vice president of United Gas Improvement Co., Philadelphia, is chairman.

The new air conditioner is a silica gel apparatus. Several layers of this material are placed in the cabinet. The air to be properly conditioned for comfort is forced by fan through the silica gel which adsorbs excess moisture. Thus dried, the air is then passed over water-cooled pipes, where it is cooled and forced through ducts to the various parts of the plant or home. Operation of the machine is entirely automatic and is controlled by weather conditions and individual preferences for comfortable temperatures. Regular production of several sizes is now under way.

Film Shows New Technique In Welding Pipelines

A new motion picture film entitled "The Multi-Flame Lindewelding Head," has been made available for industrial and school showings by the Linde Air Products Co., 30 East Forty-second street, New York. This picture has been filmed for the most part in the midwest pipeline fields, the scenes being largely of work on new oil lines that were completed in record time. It first explains briefly the details of construction of the new blowpipe head, and then is devoted principally to the correct technique of manipulating the blowpipe and welding rod.

The film is available only in the 16-millimeter size and will be furnished free of charge.

Silicon Carbide Serves As Heat Exchange Medium

BY H. L. READ and F. L. FRITSCHE
Carborundum Co., Perth Amboy, N. J.

WASTE of heat in the flue gases of steel plant furnaces long has been appreciated by progressive engineers. Numerous devices have been patented to attempt to save a portion of this loss with corresponding reduction in the fuel consumption. For many years regenerators partially met this requirement. Later, preheating the incoming cold charge by the escaping gases as in continuous billet heaters proved advantageous. Waste heat boilers were applied with satisfactory results in occasional instances. But in recent years recuperators have been employed in increasing numbers to lower the cost of heating steel.

Applies to Reheating Furnaces

Although successful applications of recuperators have been made to small open-hearth and soaking pit furnaces, the present discussion is concerned with those for reheating furnaces of the in-and-out and the continuous types. Both metallic and refractory heat exchange elements have been employed.

Refractory recuperators of common types have been criticized because cracks and severe leakage may occur in them after relatively short runs, particularly following rapid heating or cooling. Moreover, because of their numerous cement joints, which cannot be expected to remain tight, they must be operated with small differences in pressure between the air and the flue gas. These weaknesses have been minimized in two ways. The first method to avoid pressure in the recuperator involves drawing the air from the atmosphere through the heat exchanger by either stack draft or an exhaust fan capable of handling air at the maximum temperature and pressure necessitated by the conditions. Such apparatus now available is capable of withstanding temperatures of 1400 degrees Fahr. or a little higher. The second method, employed in recuperators built by the Carborundum Co., Perth Amboy, N. J., is to provide a type of joint between the various refractory pieces that will permit slight movement of the setting without the development of cracks or broken shapes.

A satisfactory joint of this nature for which patents have been applied, is shown in Fig. 1. Tapering recesses of suitable depth are formed around the edges of the tile where they make contact with other pieces. These cavities are caulked with a cement which retains a certain amount of resiliency at high temperatures. A hard setting cement would defeat the purpose of this device. When small distortions appear, generally during heating or cooling of the unit, there is enough elasticity in these joints to allow the motion to take place without production of cracks between or in the tile. Leakage of air to flue gas or the reverse thus is prevented.

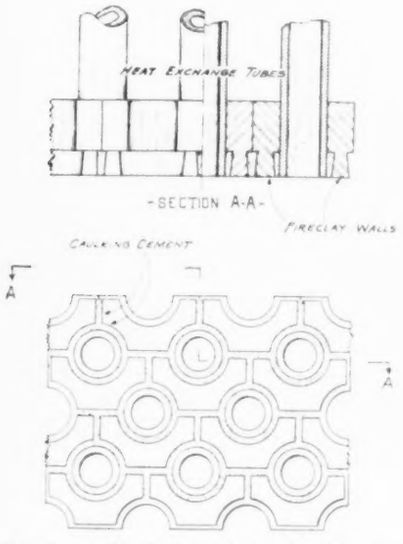


Fig. 1—Suitable joint for refractory recuperators which allows a slight movement in the setting

Cites Important Advantages

Fireclay, which has been used for the partitions between the flue gas and the air, has several favorable points the most important being its comparative cheapness and availability. Against it are relatively low thermal conductivity and strength, susceptibility to cracking and spalling with sudden temperature changes, and lack of uniformity in structure.

In recent years silicon carbide has been given intensive study as a heat exchange medium. The compound, a product of the electric furnace at a temperature of about 4000 degrees Fahr., is crushed, properly graded and bonded, and molded by hand or hydraulic pressure to the desired shapes. After drying, it is fired at high temperatures in ceramic kilns and is thereupon ready for use. Properly made, silicon carbide refractories come accurate to size, have extremely low cracking and spalling tendencies and possess the following properties at 2460 degrees Fahr:

Crushing strength, lbs/sq. in.	10,000
Cross breaking: modulus of rupture, lbs./sq. in.	900
Thermal conductivity, B.t.u./hr./sq. ft./degree Fahr./in.	105

The best silica brick tested in the same way showed a modulus of rupture of 178 pounds per square inch and a thermal conductivity of 12.2 B.t.u. per hour per square foot per degree Fahr., per inch. Good fireclay has a strength modulus and a conductivity in the same units of 113 and 9 respectively.

Problems Are Different

The theory of thermal conductivity in a recuperator heat exchange medium apparently has been misunderstood. Text books disclose that under many conditions the resistance of the dividing wall is relatively unimportant as compared with that of the films of gases. This is correct where large or even moderate transfer rates are involved (as with condensing vapors, or strongly forced convection) especially when thin metal walls of high conductivity are used. The circumstances are, however, entirely different in refractory recuperators since their nature prevents the use of the considerable pressures needed to produce the large velocities required to bring about high rates of transfer, and since the walls must have an appreciable thickness. Consideration of the mathematics involved in a typical problem will clarify this last point.

Assume that two recuperator tubes are made with an inside diameter of three inches, an outside diameter of 4½ inches and a thickness of 0.75-inch—one of silicon carbide and the

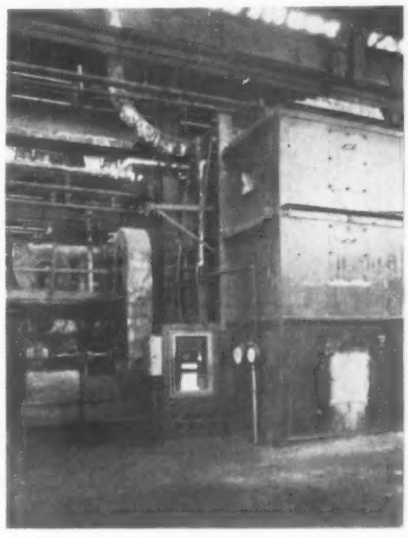


Fig. 2—Recuperator which serves a 4-door furnace for heating various sizes of ingots and billets

other of fireclay. If the air and flue gases each are traveling at 30 feet per second what are the coefficients of heat flow for both cases in B.t.u.'s per hour per square foot of internal surface per degree Fahr., mean temperature difference?

The value of the coefficient is calculated from the expression:

$$H = \frac{1}{\frac{1}{E_1 A_1} + \frac{L}{KA} + \frac{1}{E_2 A_2}} \text{ where}$$

H = B.t.u./hr./sq. ft. of internal surface per degree Fahr. mean temperature difference.

L = thickness in inches = 0.75-inch.

K = thermal conductivity in B.t.u/hr./sq. ft/degree Fahr./inch thickness.
= 105 for silicon carbide at about 1700 degrees Fahr.
= 7.05 for fireclay at about 1700 degrees Fahr.

A_1 = Wall area in sq. ft. for heat absorption to the air (inner surface) = 1 sq. ft.

A = mean area in sq. ft. for conduction of heat through the wall corresponding to 1 sq. ft. internal surface = $\frac{3.75\pi}{3\pi^1}$ = 1.25 sq. ft.

A_2 = mean area in sq. ft. for absorpting heat from the hot gases (outer surface) corresponding to 1 sq. ft. internal surface = $\frac{4.5}{3}$ = 1.5 sq. ft.

E_1 = B.t.u./hr./degree Fahr. mean temperature difference per sq. ft. of surface A_1.
= 9.0 for silicon carbide.
= 8.7 for fireclay.

E_2 = B.t.u./hr./degree Fahr. mean temperature difference per sq. ft. of surface A_2.
= 9.0 for silicon carbide, disregarding radiation of CO_2 and water vapor.
= 8.7 for fireclay, disregarding radiation of CO_2 and water vapor.

Therefore:

For fireclay:

$$H = \frac{1}{\frac{1}{8.7} + \frac{0.75}{7.5 \times 1.25} + \frac{1}{8.7 \times 1.5}}$$

= 3.68 B.t.u./hr./sq. ft. of inner surface/degree Fahr.

For silicon carbide:

$$H = \frac{1}{\frac{1}{9 \times 1} + \frac{0.75}{105 \times 1.25} + \frac{1}{9 \times 1.5}}$$

= 5.24 B.t.u. hr./sq. ft. of inner surface/degree Fahr.

In other words, for the parallel conditions specified a square foot of interior surface of a silicon carbide tube will transmit 42 per cent more heat in the same time with the same mean temperature difference than a square foot of a similar sized fireclay tube.

Life Would Be Short

The calculation, however, fails to take into consideration the fact that although a ¾-inch thick silicon carbide tube is amply strong for even severe service conditions, so thin a fireclay tube (regardless of manufacturing difficulties) would be far too weak to stand up for any length of time. The fireclay tube would not be made less than 1½ inches thick. In that case, H = 3.27 for the fireclay tube; the silicon carbide tube has a 60 per cent higher overall coefficient of heat transfer.

The foregoing calculations, while interesting from a theoretical standpoint, cannot be considered of great practical importance without some experimental evidence to substantiate them. A carefully conducted series of tests was made a few years ago at the plant of a well-known glass manufacturer where the rates of heat transmission of fireclay and silicon carbide recuperator ducts were obtained under closely comparable conditions. For practical purposes the design and heating surface of the two recuperators were the same, and each was attached to a natural gas fired revolving pot. Both pots were turning out the same class of work under similar conditions. The overall rate of heat transfer for the fireclay ducts was 1.56 B.t.u. per hour per square foot per degree Fahr. mean temperature difference, whereas that for the silicon carbide was 2.79, or over 78 per cent better than the fireclay.

Both coefficients are lower than those calculated mainly because the air velocities during the test were much less than the 30 feet per second

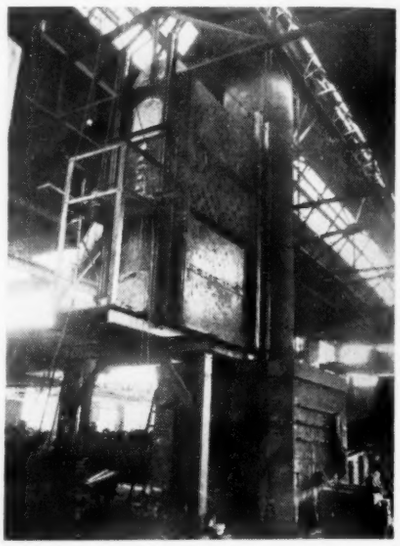


Fig. 4—Single pass recuperator serving a 30-ton malleable iron air furnace

previously assumed. The actual velocity was only approximately 3 feet per second which is commonly used when fireclay makes up the heat transfer medium.

Pressure Differences Greater

Velocities of 30 feet per second, however, are not unusual in silicon carbide recuperators. The reason for this wide divergence is that as previously mentioned considerably greater pressure differences are required for the higher velocities. Aside from the fact that under the same conditions the permeability of fireclay tubes is from 10 to 100 times that of properly made silicon carbide tubes of the same dimensions, the pressure differences permissible with fireclay are always much less than with silicon carbide because of the much greater tendency of fireclay to develop cracks and leaks during use.

The importance of the higher velocities usable in silicon carbide re-

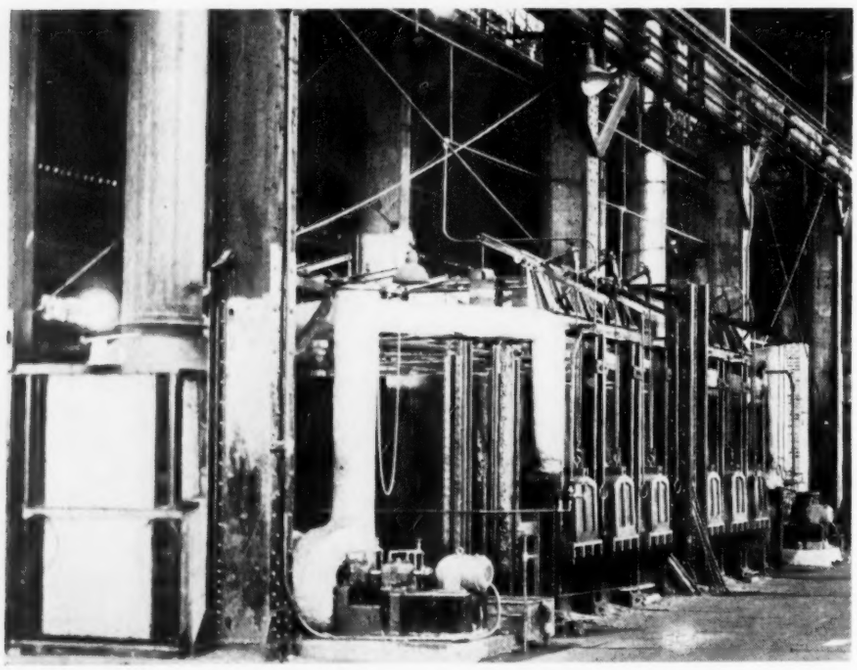


Fig. 3—Double chamber billet reheating furnace served by individual recuperators. Each recuperator is built with 24 silicon carbide tubes

Table I

Heat Absorbing Properties

Type	B.t.u. recovery per hour per tube	Average air velocity at mean temperature feet per second	Greater recovery made by type "D" per cent
A	17,600	14.5	42
B	18,600	15.0	35
C	20,700	16.0	21
D	25,000	17.5	...

Table II

Air Velocity and Temperature Increase

Type	Average air velocity in tube at mean air temp., feet per second	Temperature rise of air passing through tube, degrees Fahr.
A	8.8	972
B	7.7	1012
C	8.1	1080
D	8.8	1228

cuperators without excessive leakage is that in general the rate of heat transfer increases directly as the velocity. Fireclay recuperators are compelled to adhere to low pressure differences and velocities or else waste in leakage of hot air a large proportion of the heat recovered. Silicon carbide tubular recuperators, however, can operate under the more efficient condition of higher air velocities without serious leakage.

Second Test Is Made

A further series of tests, under purely laboratory conditions, recently was conducted with all conditions under control, contrary to the circumstances in commercial installations like those with the revolving glass pot recuperators. In this second set of experiments, air was passed in each test at moderate velocities through a single cylindrical tube 4 inches inside diameter, 5¾ inches outside diameter, and 52 inches long. Wall thickness was ⅞-inch in every case. Four different tubes were used: one made of sillimanite and designated "A"; the second of fused alumina and designated "B"; the third of about 70 per cent silicon carbide and designated "C"; and the fourth of silicon carbide with a small admixture of bonding material and designated "D" in the accompanying tables. The same furnace and other test equipment were used for each tube in turn. The outside tube temperature in all the runs was 1832 degrees Fahr. Each tube was provided with a 2-inch diameter solid fireclay rod held co-axially with the tube by small pins, whereby an annulus was formed for the passage of the air and the heat transfer rate improved considerably over that with an empty tube. Consequently, the net free area through the tube was 9.42 square inches.

In Table I are shown the comparative results on the four tubes for an air flow through each tube of 2400 cubic feet per hour measured at 70 degrees Fahr., and atmospheric pressure, or 180 pounds per hour.

It will be noted that because of the greater heat recovery in the latter tubes listed in Table I and consequent expansion in volume of the constant weight of air, the average air velocity increased likewise. This fact probably helped the rate of heat transfer in cumulative fashion. To make a comparison at as nearly as possible the same mean velocities, the data of Table II were obtained.

The great strength at high temperatures and freedom from cracking and spalling of silicon carbide make it a satisfactory construction material. Silicon carbide recuperators also are small in bulk, and low in first cost and maintenance expense.

Applications of the foregoing considerations in steel mills are shown in the illustrations. Fig. 3 shows a double chamber billet heater, each hearth of which is 8 feet wide, 10 feet deep by 3 feet-8 inches high. One recuperator with 24 silicon carbide tubes serves each chamber. Air is drawn in from the atmosphere to the upper of the two banks of tubes and taken out at about 700 degrees Fahr., from the lower bank through the insulated hood and exhauster whence it is driven to the oil burners through the insulated air piping. Products of combustion enter the recuperator from underground flues and leave by the steel stack on top of each unit. The charge is ordinarily 2½ x 2½ inch alloy or carbon tool steel billets, heated to 2100 to 2300 degrees Fahr.

Handles Semifinished Steel

Fig. 2 shows a 2-pass recuperator having 78 silicon carbide tubes connected to a 4-door reheating furnace with a working space 26¾ feet long, 9½ feet deep and 5 feet-8 inches high, fired by either natural gas or oil. The air leaves at about 900 degrees Fahr., flowing downward while the hot gases rise.

Fig. 5 is a hot producer gas fired continuous billet heater with a 2-pass recuperator of 144 silicon carbide tubes likewise operating with an exhauster on the hot air which is fed to the burners at about 700 degrees Fahr. The hearth is 50 feet long by

(*Please turn to Page 44*)

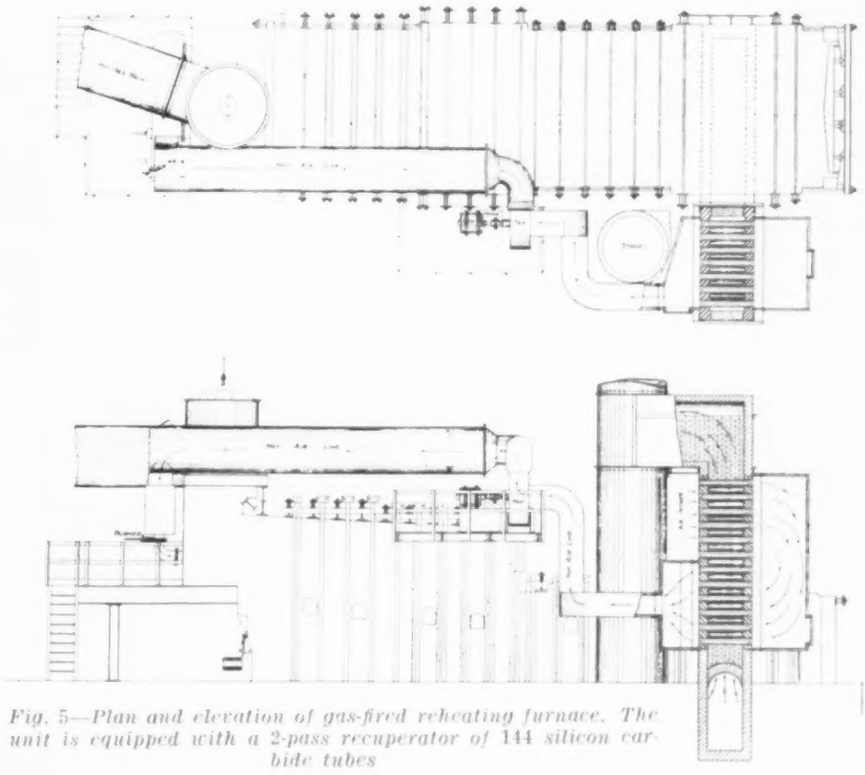


Fig. 5—Plan and elevation of gas-fired reheating furnace. The unit is equipped with a 2-pass recuperator of 144 silicon carbide tubes

Controlled Iron Oxide Slags Increase Furnace Yields

At the afternoon session of the eighth open meeting of the Metallurgical Advisory Board held at the Carnegie Institute of Technology, Pittsburgh, Feb. 8, E. H. Hollenbach, assistant engineer of tests, Cambria plant, Bethlehem Steel Co., Johnstown, Pa., in discussing the board's bulletin No. 68, entitled "The Control of Iron Oxide in the Basic Open-Hearth Process," emphasized the importance of slag control in its various phases. His remarks follow:

RESULTS experienced at the Cambria plant of the Bethlehem Steel Co., Johnstown, Pa., at the end of the first full year's run with controlled iron oxide slags, are reflected directly in increased open-hearth yields. Phosphorus and sulphur off-grades were reduced materially after a better working knowledge of slag control was obtained, and a better efficiency of deoxidizers followed. Stopper practice was improved due to the lowered iron oxide in the slag.

Sulphur Reversion Occurs

First attempts at lowering the iron oxide content were based on additions of silica to lime in the ratio of 1:1. It then was noticed that a reversion of sulphur occurred following this type of addition. When two parts of lime to one of silica were added, however, no reversion occurred and sulphur reduction continued. Using this function of sulphur removal as an indicator in much the same way as end points in chemical analyses are indicated, it became evident that basicity was maintained on the basis of combination of two parts of lime to one of silica. Conclusions summarizing this slag investigation are:

1. That a basic slag is primarily a calcium silicate of the composition of two parts of lime to one part of silica.

2. That FeO, MnO, MgO, P_2O_5 and Al_2O_3 may form compounds among themselves in the calcium silicate matrix, but in no way affect the active basicity of the slag.

3. That it is not the excess basicity, but the excess lime over that required to combine with the silica, that accomplishes the reduction of sulphur from the bath.

4. That magnesia is an undesirable compound in a basic slag, since it contributes nothing of value toward basicity, and masks by dilution, any corrective measures applied to the slag.

The other function of slag control investigated concurrently with the basicity function was that of phosphorus control in the metal. Conclusions were different from those stated in the Advisory board's bulletin No. 68 entitled "Iron Oxide Control in the Basic Open-Hearth Process." They are presented at this time in an attempt to add something to the total volume of work done on slag control.

In our early experience with slag control, it was noted that slags with a low iron oxide concentration, usually under 12 per cent total, in nearly all cases meant a reduction of phosphorus from slag into metal. Occasional heats, however, seemed to disprove this generalization, by showing low phosphorus in the metal with slag iron oxide under 12 per cent; other heats showed high phosphorus with iron oxide in the slag well over 12 per cent.

Detailed Examination Is Made

The function of slag oxidation in holding phosphorus had been so generally recognized, however, that more detailed examination of the slags of these irregular heats was undertaken. Complete slag analyses indicated that if the ferric oxide (Fe_2O_3) in the slag was in fair excess over that required to combine with the phosphoric oxide (P_2O_5), according to the reaction

$$\underset{160}{Fe_2O_3} + \underset{142}{P_2O_5} = \underset{302}{2\,FePO_4}$$

there was a reduction of the phosphorus in the metal.

Heats were tabulated and included those with low metal phosphorus, low total iron oxide (FeO) in the slag, but with sufficient ferric oxide (Fe_2O_3) to combine with the phosphoric oxide (P_2O_5) in the relation just quoted, as well as heats with high metal phosphorus, lime-silica ratios in line with the preceding group of heats, and with high total iron oxide in the slags, but with insufficient Fe_2O_3 to combine with the P_2O_5.

When this apparent basis of control was noted, the determination of P_2O_5 and Fe_2O_3 on the working slags of all heats was adopted as a routine part of our open-hearth practice. When conditions are not favorable to low phosphorus in the metal, two corrections are of primary importance:

1. Make up deficiency of slag oxidation by means of ore or scale.

2. Set up conditions in the slag most favorable to high Fe_2O_3 content.

As mentioned in bulletin No. 68, ferric oxide (Fe_2O_3) is the result of gas oxidation of the iron oxide present in the slag. Further, in order to increase the Fe_2O_3 content it is necessary to decrease the activity of the slag. The addition of burnt lime to a basic slag decreases its fluidity and causes an increase in the ratio of Fe_2O_3 to total FeO. This manipulation with lime, therefore, is satisfying the second correction as was heretofore outlined.

Summarizing, the proposition is offered that in order to hold phosphorus in the slag it is necessary to increase the ferric oxide (Fe_2O_3) content to the point where the phosphoric oxide (P_2O_5) is combined as ferric phosphate; that lime is important chiefly because it is the most active agent in the process of obtaining a high ferric oxide (Fe_2O_3) content. Since this form of control was instituted at the Cambria plant, phosphorus off-grades are a rare occurrence.

Revives Basic-Bessemer Process in England

Another stage has been reached in the development of the iron and steel industry at Corby, Northamptonshire, England, where the first heat of steel has been made in the basic bessemer department of the new works of Stewarts & Lloyds Ltd., according to the *London Times*.

In the presence of officials of the firm and of H. A. Brassert & Co. Ltd., consulting engineers for the erection and operation, molten metal direct from No. 1 blast furnace was poured into the first of the three converters, and high-grade steel suitable for the manufacture of tubes was made from this first heat. It marked the beginning of the revival of the basic bessemer process in this country, and the manufacture of steel and tubes direct from native ores.

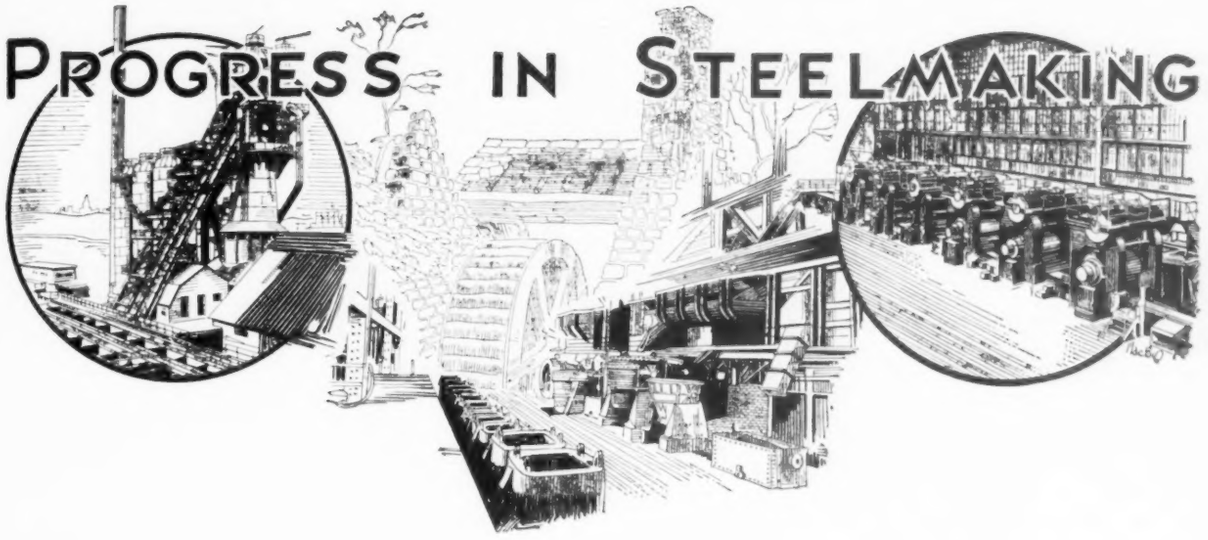
The manufacture of basic bessemer steel at Corby will lead to the opening up of large ore deposits in Northamptonshire. Already a large community of iron and steel makers has been developed at Corby.

Construction of the works, which began two years ago, is not yet complete. The tubemaking section is expected to be finished about May or June, when the firm will complete its scheme for making steel tubes from local ores. Provision has been made for ore-treating plant, coke ovens, by-product plant, rolling mills, and tube works.

Will Construct Tube Mill

Tube Products Ltd., Birmingham, England, has placed an order with the Yoder Co., Cleveland, for a 3½-inch electric weld tube mill. The welder, designed under specifications of the Johnson patent, will be built in England. The mill will take skelp off the reel and will cut, form, weld and size it to specified diameters. Shipment of mill will be made in about three months.

PROGRESS IN STEELMAKING



Eliminates Wastage of Gas

Distribution of oxygen and acetylene in pipe lines to the scrap cutters affords a means for positive control of pressures and consumption of gases. With excess pressures, the operators have little opportunity to waste oxygen as is the case when working with cylinders. Individual handling of oxygen cylinders is eliminated thus leaving the operator's time entirely free for productive scrap cutting. Moreover, a continuous supply of gases always is available from the manifold and generators.

• • •

Indicates Number of Wraps

Actual count of the number of wraps of strip steel on the reels serving reversing cold strip mills is made possible by a simple counting device. The counter, when rotated in one direction, adds and in the other it subtracts. Thus, if 150 wraps are wound up, 150 wraps must be unwound, irrespective of the thickness of the cold rolled strip going through the mills. Too selsyns serve as a mechanical tie between the reel drum and the wrap counter. These are employed to eliminate shafting and gearing, and to permit convenient location of the indicator. By means of a simple mechanical lever or key the counter can be reset to the zero position.

How Clothing Is Made To Resist Sparks

SIMPLE BUT EFFECTIVE—Operators of oxygen lances who frequently are called upon to open the iron notch of blast furnaces and tap holes of open hearths and to remove hot tops from ingots, welders engaged in cutting metals and torch operators in scarifying steel, employes in bessemer departments, teemers working on the pouring platform at steelworks and electric furnace crews will be interested in the following method of fireproofing clothing: The garments first are dipped into a solution of ¾-pound of sodium stannate in 1 gallon of water, wrung out and then dipped in a solution of ¼-pound of ammonium sulphate per gallon of water. After wringing out thoroughly and drying, the garments are ready for service. Tests disclose that garments subjected to this treatment will withstand five or more dry cleanings without losing their fire-resisting qualities

• • •

Capstan Is Motorized

Cars of ore, coke and limestone on blast furnace trestles now may be spotted over their respective bins by a motorized vertical capstan. The motor is attached direct to the side of the spotter housing, thus securing permanent alignment of motor shaft and minimizing the foundation measurements. Machine finish prolongs the life of the haulage rope.

• • •

Aids in Bright Drawing

Potassium base lubricant is recommended for drawing fine sizes of extra bright wire at high speeds. Keeping the machine free from soap residue promotes a bright surface on the wire.

• • •

Life of Blades Extended

Hard facing the shear blades used for cold shearing 11-gage sheets is the practice of a sheet producer in the Great Lakes district. The material used for this purpose consists

of cobalt, chromium and tungsten and is applied with an oxyacetylene blowpipe. Tests show that the hard faced blades last from two to three times longer between grinds than untreated blades.

• • •

Eliminates Inaccuracies

Girders, end truck and trolley of a new type steel mill crane are all of welded construction. A lever-type scale is an integral part of the trolley so that when a load is hoisted its weight is obtained instantly and is visible. Direct reading from the floor is obtained by a "weightograph." By weighing the entire load the inaccuracies incurred when obtaining the combined weight by weighing only part of the load, are eliminated.

• • •

Minimizes Operating Delay

Foundation bolts of a large steel casting that holds one of the bearing housings on the main drive shaft of a blooming mill in this country recently were sheared off flush with the floor. Welding the broken bolts back enabled the mill to resume operation without as long a delay as would have been necessary had the foundations been dug up and the bolts replaced. The bolts, 3 inches diameter, were fashioned to a chisel point, electrically welded and then annealed with an oxyacetylene torch.

• • •

Mixer Temperatures Vary

Temperature measurements at the inner wall of a 600-ton mixer at a German steel plant and at the surface of the hot metal disclosed that during the charging period the temperature around the charging door is about 86 degrees Fahr. higher than near the pouring spout while a complete balance is obtained throughout the mixer during the working period and pouring.

• • •

Facing Stops Infiltration

Protection to refractories from infiltration of high temperatures, gases and flame penetration is claimed to be afforded by a new refractory facing. The material forms a smooth jointless monolithic lining, serves as a sealer and insulator and affords protection up to at least 3000 degrees Fahr. even under drastic temperature changes. Fusion at a temperature of 1800 to 2000 degrees Fahr. is required.

Silicon Carbide Serves As Heat Exchange Medium

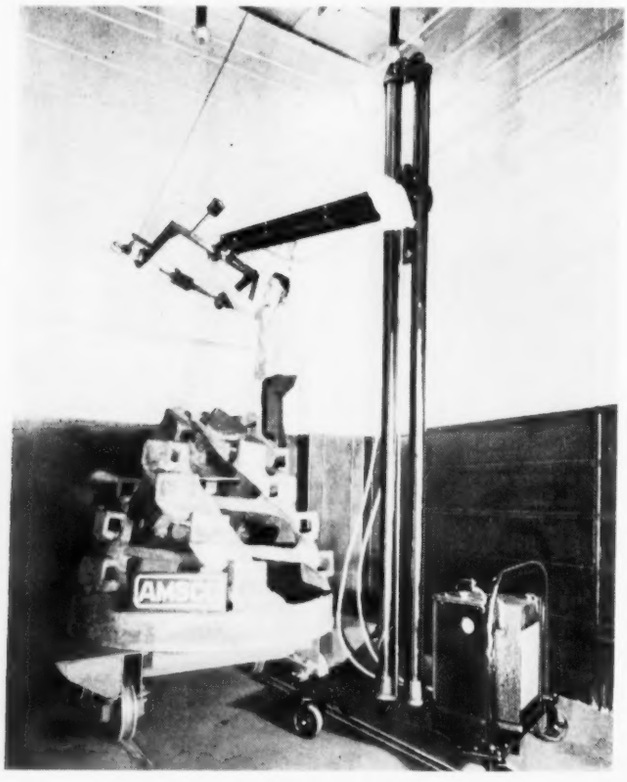
(*Concluded from Page* 41)

10 feet-8 inches wide, turning out under good conditions with cold charging about 20 tons of 4 x 4-inch billets per hour for a wire mill. One of the important advantages of the silicon carbide tube recuperator is that it readily is accessible for inspection and maintenance.

A similar 372 silicon carbide tube recuperator for a new rolling mill furnace in a large plant is now under construction. This furnace is to handle 30 tons of slabs per hour with cold charging and 60 tons with hot charging. The air is to be heated to about 700 degrees Fahr., under the former condition and 1000 degrees Fahr., under the latter. Mixed gas of about 250 B.t.u. per cubic foot is the fuel.

In Fig. 4 appears a single pass recuperator of 45 silicon carbide tubes attached to the stack of a 30 ton malleable iron air furnace making one heat per day with pulverized coal firing. This represents probably the most severe conditions to be encountered in practice, for the dust and ash laden gases around the tubes rise in about five hours from nearly cold to about 2800 degrees Fahr. After three years' service more than 80 per cent of the tubes originally installed are still in use. The saving in fuel is about 22 per cent based on the amount used with cold air.

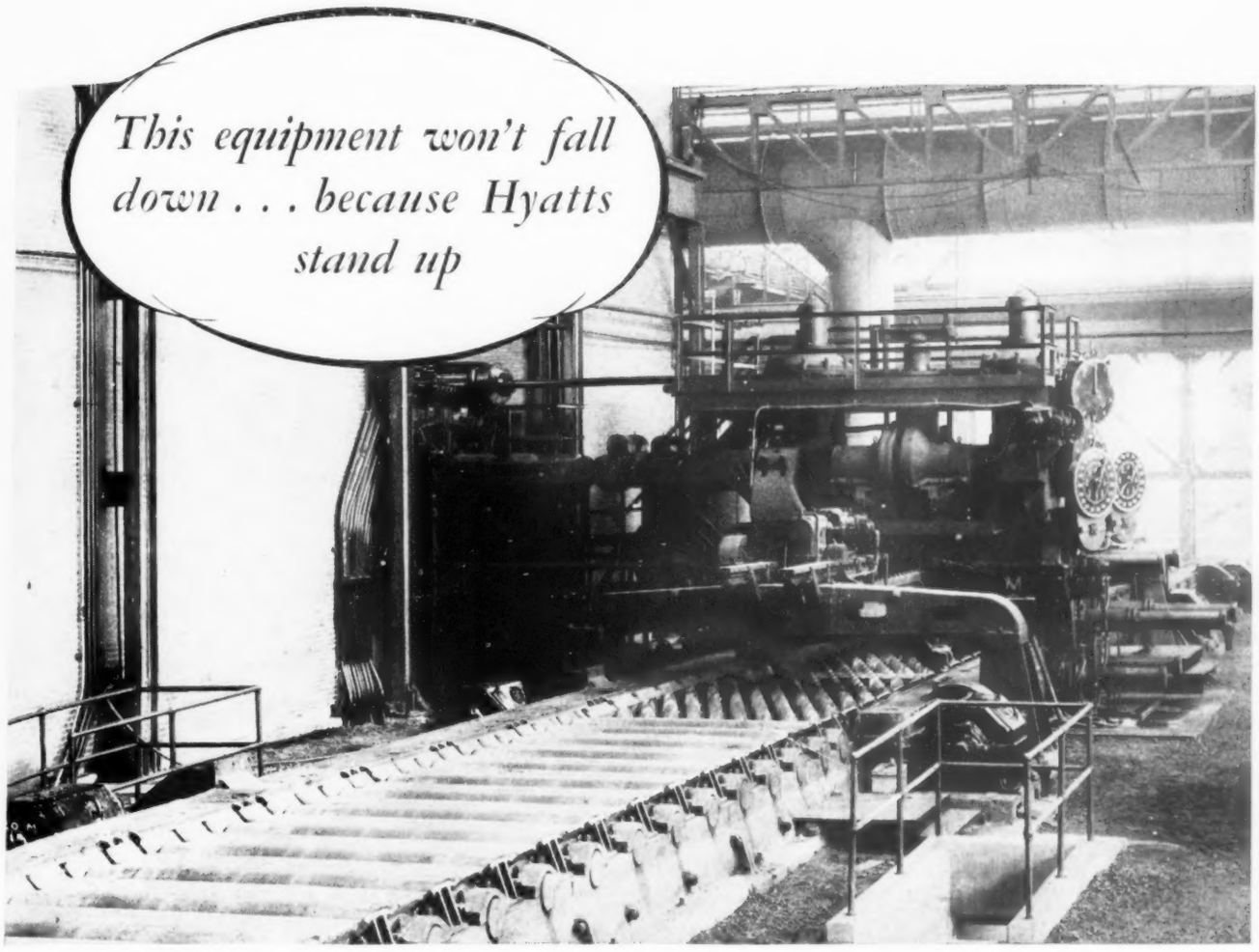
Obtaining "Inside Information"



◆

STEEL FOUNDRY INSTALLS X-RAY LABORATORY: Recently erected in the plant of the American Manganese Steel Co., Chicago Heights, Ill., this 400,000-volt X-ray unit has proved an invaluable aid in production of sound manganese steel and chromium-nickel alloy castings. With the X-ray, the experienced radiographer can, so to speak, "see into" the casting to a depth of 5 inches of metal, and feel sure that all defects within the area radiographed, whether shrinks, spongy metal, blowholes, internal cracks or inclusions, will show up clearly. When the defect is known, it is possible to revise the design or method of manufacture so that commercially sound castings can be produced continuously. While it is not feasible to X-ray all castings, pilot castings of a given lot are examined, as well as many large or expensive cast products. Equipment shown was built by the General Electric X-Ray Corp., Chicago

◆



On the A. M. Byers Universal plate mill, built by the MORGAN ENGINEERING COMPANY, Alliance, Ohio, all tables are Hyatt equipped.

Uninterrupted operation and care-free performance justify the use of Hyatt Roller Bearings. The bearings selected for this or any comparable installation are individually designed to conform with specific operating conditions, to eliminate friction, reduce maintenance, minimize wear and stand the gaff.

That's why so many machinery and equipment builders standardize on Hyatts. And that is also why the many users of this equipment know they can rely on the protection that these better bearings afford. Hyatt Roller Bearing Company, Newark, Detroit, Chicago, Pittsburgh, Oakland.

HYATT

ROLLER BEARINGS

PRODUCT OF GENERAL MOTORS

Meeting of A.I.M.E. Surveys Metallurgical Progress

ADVANCE in science along the broad front of iron and steel and metal working was indicated by papers presented at the 144th meeting of the American Institute of Mining and Metallurgical Engineers, New York, Feb. 18-21. Refinements, and in some cases, new processes were revealed; a new alloy metal was announced; and, in mining, a new ore crushing process, said to have many advantages.

The iron and steel division, in its eight sessions, covered a wide range of subjects, with the Howe Memorial lecture by Earl C. Smith, chief metallurgist, Republic Steel Corp., Youngstown, O., a feature. The institute of metals division held three technical sessions in its own behalf and both this and the iron and steel divisions met jointly with the petroleum division for a two-session symposium on the use of metals in the petroleum industry. The annual lecture was presented by Dr. C. A. Edwards, professor of metallurgy, University college, Swansea, Wales, on the subject of "Gases in Metals."

HENRY A. BUEHLER, state geologist and director, Missouri bureau of geology and mines, Rolla, Mo., was elected president of the institute. John M. Lovejoy, president Seaboard Oil Co., New York, and Dr. Paul D. Merica, assistant to president, International Nickel Co. Inc., New York, were elected vice presidents.

Newly elected directors are: Dr. Charles K. Leith, professor of geology, University of Wisconsin, Madison, Wis.; Edwin E. Ellis, vice president in charge of mining, raw materials and lake shipping, United States Steel Corp., New York; Wilber Judson, vice president, Texas Gulf Sulphur Co., New York; Wilfred Sykes, assistant to the president, Inland Steel Co., Chicago; and R. M. Roosevelt, vice president, Eagle-Picher Lead Co., New York.

The Saunders medal went to James MacNaughton, president, Calumet & Hecla Consolidated Copper Co., Calumet, Mich.; the Douglas medal to George Cameron Stone, New York; and the Johnson award to Francis M. Rich, Republic Steel Corp., Youngstown, O., as noted in the Feb. 18 issue of STEEL. Honorary membership was conferred upon T. A. Rickard, historian and anthropologist, Victoria, B. C.

That the United States should maintain a dominant position in world affairs as a result of its natural mineral advantages was the contention of Howard N. Eavenson, of Eavenson, Alford & Hicks, Pittsburgh, in his address as the retiring president. "As we know civilization today," he said, "those nations having the greatest supplies of mineral fuels are and evidently are destined to be in the future the most powerful and, if the power is properly used, the most civilized." The coal reserves of the United States and Canada constitute about 70 per cent of the world's total, he added.

Mineral Resources Conservation Plan

Necessity for conserving and developing the country's mineral resources was brought out by Dr. Charles K. Leith, professor of geology at the University of Wisconsin and vice chairman of President Roosevelt's planning committee for a mineral policy. To this end, the committee has formulated a plan, he said, which includes a program of federal conservation and development by industrial monopoly such as is permitted under the National Recovery act.

He said a review of conditions indicates a strong case for the public interest in mineral waste. The trouble is not so much in slowness of technological improvements—advances in this field have been impressive—but in economic and social conditions under which unrestricted competition in some mineral industries has caused over-development, over-production, huge wastes of raw materials and bad conditions of employment. This seemed to be especially marked in oil, coal, copper ,lead and zinc, he stated.

The report, Mr. Leith declared, favors advance consumption estimates for these "surplus" minerals and some kind of control of capacity, production or price.

Pointing to a shortage of certain minerals needed in a war emergency, Dr. Leith said the committee has urged direct expenditure of government funds in developing these deficit minerals. This deficit group includes nickel, antimony, manganese, chromite, mercury, tungsten, tin and certain grades of mica.

IN THE Howe memorial lecture, Earl C. Smith, spoke particularly of the importance of petrography, or rock picturing, to iron and steel metallurgy. This new process, which affords a quick glance through a translucent slice of rock slag as thin as a sheet of tissue paper and mounted on a glass plate for study under a powerful illuminated microscope, tells the story of what is going on in the steelmaking furnace more accurately, more rapidly and more reliably than lengthy chemical analyses, he said.

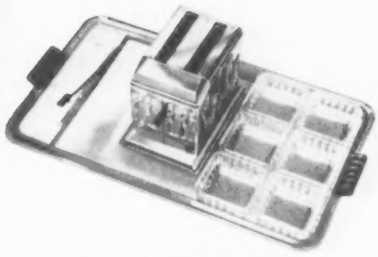
"If you watch the refuse or slag discarded from a steel furnace," Mr. Smith continued, "the steel will take care of itself." At certain Republic mills, he asserted, the study of petrographs had enabled the operators to increase production 2 to 3 per cent and get consistently uniform steel. In one case, the yield of an open-hearth furnace was increased from 72 to 85 per cent. Open-hearth furnaces make 85 per cent of the United States annual steel production of approximately 50,000,000 tons, so, he stated, a 2 per cent increase throughout the industry would add about 850,000 tons to its annual production.

Some slags are white, some are light brown, others dark brown and a few jet black. In all, the crystalline structure is different. The eye of the trained metallurgist, Mr. Smith said, is quicker and more accurate than the hand of the chemist in determining whether the white hot metal in the furnace is going to meet specifications weeks or months later when it enters industry as a steel product.

Pointing out that petrography has shown the degree to which steel is contaminated by the materials composing the furnace lining, Mr. Smith declared that what the steel industry needs are "fire and furnace bricks inert to molten metals and slags, insensitive to heat shock and capable of working at temperatures of 3500 degrees Fahr." Needed also, he concluded, are the proper facilities for steel men to apply petrography intelligently to the control of all mill operations.

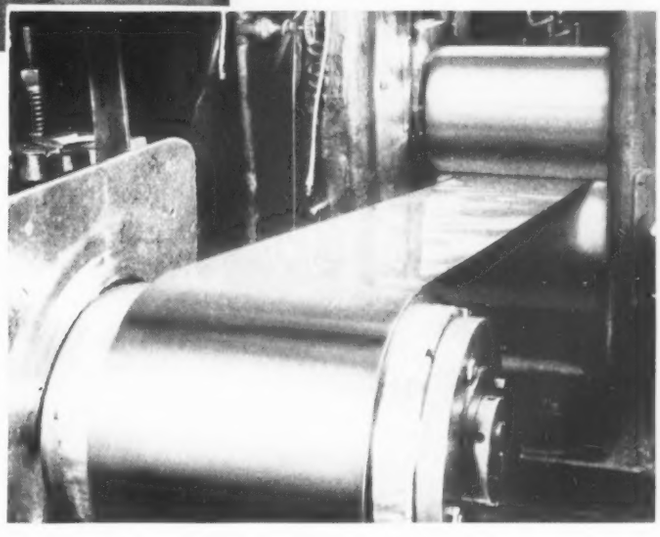
A NEW ore crushing process, wherein the mineral particles are shattered by the films of superheated water in which they are surrounded, was described by R. S. Dean, chief engineer, division of metallurgy, bureau of mines, Washington.

He said that the process called for the placing of the particles of ore in strong steel containers or 'bombs" and the admission of steam at pressures varying between 150 and 250 pounds per square inch. A light film of superheated water condenses on the surface of the ore. Then, the steam pressure is suddenly released and the rush of superheated water back into steam is so violent that the force of a powerful explosion is exerted on the ore, shattering it. The explosion wave breaks down the mineral particles preferentially along certain planes of low fatigue strength, he



Here's one kind of quality product made with No. 3 finish Acme cold rolled Superstrip—easy forming—flawless finish. It "makes" the beauty of this well-known toaster.

Here's a big reason for the outstanding quality of Acme No. 3 finish cold rolled Superstrip—the rolls. With skill and experience, Acme rolls high finish strip to a perfection that distinguishes it.



IT'S PLANNED FOR EACH JOB—SAVES THE HIGH COST OF WASTE AND REJECTIONS

Acme Superstrip is not the result of any secret or patented process. Customers find it is better for their requirements because Acme determines just what the steel is required to do—then produces Superstrip for the job.

There is just as much difference in strip steel as in house paint. There is plenty of *good* strip steel. But, if you want to enjoy the economies of minimum waste and rejections, order Acme Superstrip. It costs no more.

Acme Superstrip is not only made to do your job economically, but it is packaged to fit your production line—another step in making Acme Superstrip a better buy.

How Superstrip users are speeding production and cutting down waste is told in the illustrated booklet, "Batting' Em Out." Send the coupon for your copy. ACME STEEL COMPANY, General Offices: Chicago. *Branches and Sales Offices in Principal Cities.*

Acme Superstrip

HOT ROLLED • COLD ROLLED • GALVANIZED • STAINLESS

The ACME Line of STRIP STEELS

ACME STEEL COMPANY, 2826 Archer Avenue, Chicago
Send, without obligation, your new booklet, "Batting 'Em Out."

Name .....
Firm .....
Street .....
City ..... State .....

said. Mr. Dean declared that the new method has may advantages over the older processes of crushing ore. He said that the power cost is less than one-fifth of that of the standard crushing apparatus.

MODERN blast furnace practice came in for exhaustive discussion at the opening session of the iron and steel division, with emphasis placed on the need for further study of conditions at and below the tuyeres, the use of proper fuels and slow wind operations. In the opinion of Francis M. Rich, Republic Steel Corp., Youngstown, O., this year's recipient of the Johnson award, slow wind operations has done more in recent years toward perfecting blast furnace technique than any other development.

In a paper on this subject, Mr. Rich asserted that while prior to the depression the primary purpose of an operator was to produce a maximum tonnage for each furnace in blast but conditions since have forced him to run his plant in a manner best fitted to the economic set-up of his company. Hence he had to employ various innovations, the purposes of which were either one of the following or a combination of them:

(1) To produce only enough pig iron for immediate consumption at a minimum cost; (2) to produce gas for boiler or mill use to supplant some higher-priced fuel; (3) to consume coke produced at the coke plant which was often handled as a by-product; and (4) to protect the cash position of the company.

To effect the desired aims, some of the following methods, were used, Mr. Rich said: (1) Slow or decreased wind, with in some cases the blast blown held as low as 25 per cent of the normal volume; (2) intermittent operation, with the furnaces shut down or "fanned" at frequent intervals; and (3) slow wind for a week or so and then normal wind for a short period, with each substantial change of wind often accompanied by a change of burden to produce a different grade of iron.

Furnaces Behave Differently

Mr. Rich discussed observations of his company on slack wind operations and declared there is one particular solution of blast for each furnace that will produce a certain tonnage of iron at a cost lower than what the cost will be at any other blast volume, with the same raw materials, prices, labor costs and equipment. He thought it was the duty of each operator to determine this point on each furnace under his supervision and thus arrive at the most economical rating for each furnace operating under a given set of conditions.

He thought that the large hearth, high-pressure furnace, with the wide top, is the best for lake ore practice. This large furnace, he said, is very flexible as far as tonnage is concerned, and is more economical to operate when the conservation of raw materials is considered.

The decreased coke rates and flue dust production on slow wind are due partly, he said, to the decreased volume of blast and partly to the slowing up of the descent of the column of stock. It is impossible, he added, to determine at present the relative effect each of these conditions has on the increased volume and which has the greater effect.

Need Research on Gas-Flow

Mr. Rich believed more research and experimentation should be done on gas-flow in the blast furnace, to determine the location of the greatest channeling. Once this has been satisfactorily determined for the conditions present, intelligent effort, he asserted, can be made to correct the bad features of gas-flow by changes in filling or design of the top-charging mechanism and furnace lines.

Additional investigations, similar to those of the bureau of mines, should be made with models. He suggested that, when the shaft of the model furnace is full, the material be abstracted from holes located in the walls and at the bottom of the model, until the furnace is entirely filled with stock charged at a constant stock level. In addition to the variables already checked by the bureau of mines, the effects of changes in design of the charging apparatus and furnace lines should be determined, he concluded.

RALPH H. SWEETSER, consulting engineer, New York, discussed blast furnace fuels with reference to anthracite coal. He described some of the peculiar qualities of anthracite, the size of anthracite used for blast furnaces and referred to it as having been used for more than three-quarters of a century "without its character being well-known and its superior qualities being recognized."

Such being the case with regard to the character and qualities of anthracite, the speaker believed that it follows that possibly present blast furnace practice could be much improved if there were a better understanding of what takes place with by-product coke within the big column near the center of the furnace, and what happens in the region between the level of the tuyeres and the level of the iron notch. He thought it would also be worth while to determine whether the superior quality of anthracite pig iron was due to the anthracite alone or partly from the small diameter of the anthracite blast furnace.

Discussing furnace practice in general, Mr. Sweetser declared that the region of the blast furnace extending downward from the level of the center line of tuyeres is the most important part of the furnace, yet, he said, it is the least known. The United States bureau of mines has made some commendable attempts to work out this problem of the hearth but it has been too much hampered, Mr. Sweetser declared, by politics and lack of necessary funds to complete the big job of a thorough exploration of the hearth of a modern blast furnace while in operation. He believed this work should be undertaken by the American Institute of Mining and Metallurgical Engineers as sponsor, in conjunction with the staff of the bureau of mines. The costs should be borne by the whole iron and steel industry, which, he pointed out is ably represented by the American Iron and Steel institute.

WHILE this country may exhaust high-grade iron ores in 40 or 50 years, Charles Hart, president, Delaware River Steel Co., Chester, Pa., said that he was not prone to worry about the future requirements of the American blast furnace. He pointed to large reserves of ore in this country which could be used through beneficiation and to heavy reserves of rich foreign ores. He thought, however, that American operators would have to make some rather radical changes in their iron smelting practices. He said that he didn't know whether in 50 years or so the American furnace will be a modified type of blast furnace, or an electric furnace or whether it will be essential to use sponge iron, but he believed it would be necessary to revise smelting practices to meet conditions which will eventually develop with regard to ore.

Foreign Ore Not Competitive

Referring to foreign ores, he said that he was inclined to regard them as "supplementary" rather than "competitive" supplies. Mr. Hart enumerated some of the more important ore reserves in other parts of the world. He said that it has been estimated recently in conservative quarters that there are three and a half billion tons of good ore in Newfoundland. Sweden has a billion tons of high grade ore. North Africa, considering the section adjacent to the Mediterranean sea, has very little, either in point of size of reserves or quality of ore. He said one new and important source of ore has been discovered on the west coast of Africa. He referred to this ore as being of good quality.

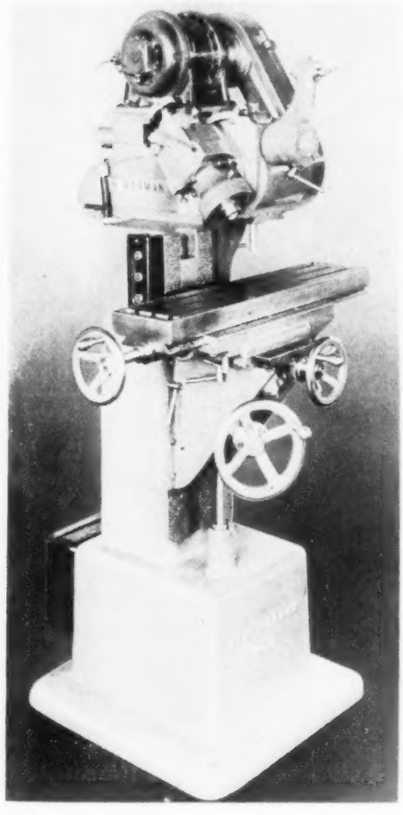
He thought that possibly the richest ore to be found in any foreign country is located in Brazil. It runs around 69 per cent in iron and it is believed that there is a reserve of

(Please turn to Page 54)

NEW EQUIPMENT

Milling Machine—

Van Norman Machine Tool Co., Springfield, Mass., recently brought out a new miller incorporating the flexibility of previous machines built by the company. Known as the No. 6, the new unit, shown herewith, differs from the other machines in the company's line chiefly in its smaller size and in the fact that it is built with hand feeds only. It is designed to handle, with a minimum of set-up time, the wide range of operations occurring in pattern and experimental shops and tool rooms.



As it is on all Van Norman millers, the cutter-head of the No. 6 may be swiveled to mill vertically, horizontally or at any angle. Combined adjustments of the cutter-head and the ram make it possible to mill any angle throughout the full run of the table with a standard milling cutter. On practicaly any piece, all operations can be completed without disturbing the original set-up.

Sliding gears and 3-step pulleys controlled by quick-change shifting levers provide for nine speeds ranging from 80 revolutions per minute to 1450 revolutions per minute. Generous ribbing is employed on the inside of the column and base.

• • •

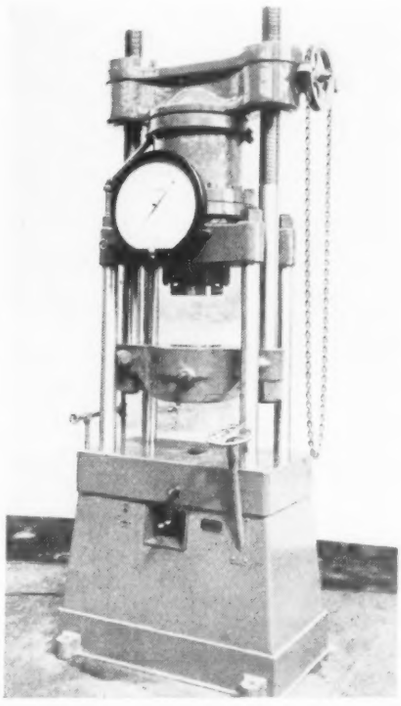
Testing Machine—

Baldwin-Southwark Corp., Philadelphia, calls attention to the fact that the Southwark-Emery type of testing machine, employing as it does the entirely separate hydraulic loading and weighing systems, has become so intimately associated with the name of Baldwin Southwark that it is not generally known the latter builds other types of testing machines, some of which, while having a somewhat lesser percentage of accuracy, are suitable for many services. Reference is made to the type R. D. testing machines, shown herewith, which employ the same high precision gage that is used in the Southwark-Emery type, but combine the hydraulic weighing and loading systems into one. The ram and cylinder are carefully ground to small clearances so that no packing between same is necessary. Guarantees of accuracy approaching the Southwark-Emery types are made. Certain precautions as to control, loading, etc., are necessary but such limitations are usually not difficult of achievement.

Left—Van Norman miller embodies knee of box-type construction

Right—Osborn jolt squeeze stripper type molding machine

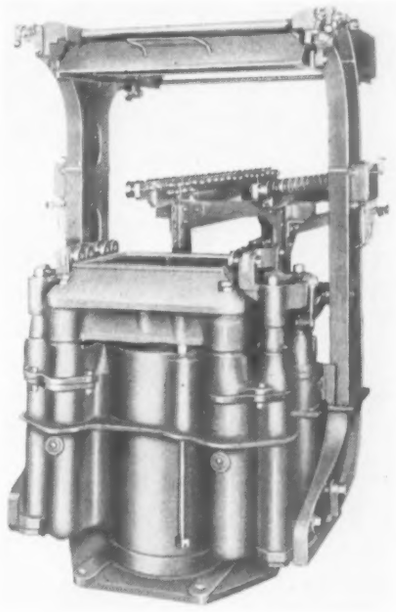
Below—Type R.D. testing machine built by Baldwin-Southwark Corp.

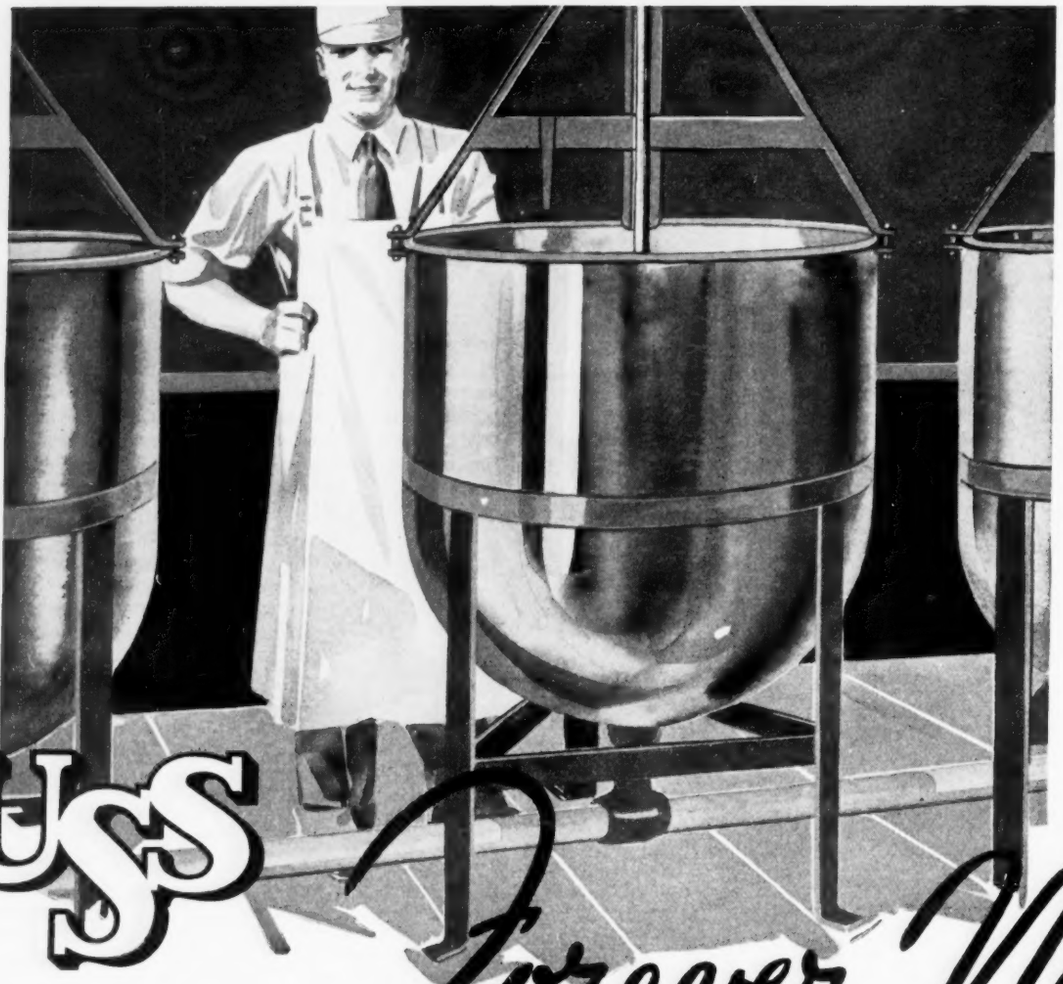


• • •

Foundry Molding Machine—

Osborn Mfg. Co., 5401 Hamilton avenue, Cleveland, has developed a jolt squeeze stripper type molding machine which may be equipped with either automatic or manual control. Automatic control covers jolt, squeeze and draw operations. When the flask is filled with sand, the operator pushes a lever which causes the mold to be jolted a predetermined number of blows. The squeeze head then is pulled forward and another lever is pushed which causes the squeeze piston to rise and squeeze the mold at full pressure for a predetermined time interval, after which the exhaust automatically opens and the piston starts on the downstroke. Speed of





USS Forever New

AGE holds no terrors for equipment fabricated from USS Stainless and Heat-Resisting Steels. Years of use cannot rust or mar the shimmering surface of this ageless metal.

For any application in which you want lasting beauty and freedom from contamination, specify USS Stainless Steel. There is a type suited to your needs . . . in resistance to specific corroding agents and in the physical qualities which you need. Our representatives will be glad to cooperate with you in the determination of the right Stainless Steel for your requirements.

AMERICAN SHEET AND TIN PLATE COMPANY, *Pittsburgh* - - - - - - - - - SHEETS AND LIGHT PLATES
AMERICAN STEEL & WIRE COMPANY, *Chicago* - - COLD ROLLED STRIP STEEL, WIRE AND WIRE PRODUCTS
ILLINOIS STEEL COMPANY, *Chicago* - - - BARS, PLATES, SHAPES, SPECIAL AND SEMI-FINISHED PRODUCTS
CARNEGIE STEEL COMPANY, *Pittsburgh* - - - - - SHAPES, PLATES, BARS AND SEMI-FINISHED PRODUCTS
NATIONAL TUBE COMPANY, *Pittsburgh* - - - - - - - - - - - - - - PIPE AND TUBULAR PRODUCTS

Pacific Coast Distributors—COLUMBIA STEEL COMPANY, San Francisco, Calif. ——— *Export Distributors*—UNITED STATES STEEL PRODUCTS CO., New York, N. Y.

United States Steel Corporation Subsidiaries

USS STAINLESS AND HEAT RESISTING STEELS

USS CHROMIUM-NICKEL ALLOY STEELS ARE PRODUCED UNDER LICENSES OF THE CHEMICAL FOUNDATION, INC., NEW YORK, AND FRIED. KRUPP A. G. OF GERMANY

pattern travel on the downstroke is controlled automatically. Control valves on the manually and automatically operated machines are similar, the difference in operation being that, with automatic control, only one touch of the operating lever is needed to perform the entire operation sequence.

Numerous features of design have been included to provide durability. A long squeeze piston gives prolonged alignment of the piston and a continuous smooth draw. The jolt piston is of the bottom strike design which it is claimed gives the best ramming condition and reduces the strain on the guide pins and bushings.

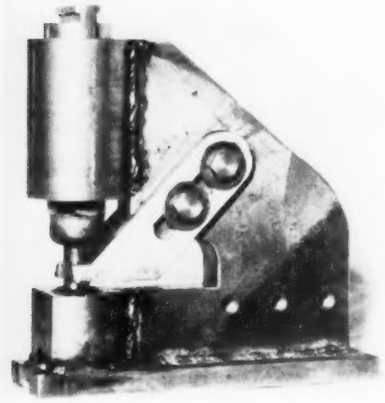
During the draw operation, the lifting frame is held up by an air piston and cross arm operating at each end of the lifting frame. In the draw position, these arms are held securely against a positive stop by a hold-up piston. After the draw is completed, the lifting frame is lowered by exhausting the air beneath the hold-up pistons, an operation which is accomplished quickly without shock or strain on the machine. This type of machine is available in a range of sizes.

• • •

Multi-Unit Punches—

Service Machine Co., 164 Miller street, Elizabeth, N. J., has placed on the market a line of standard multi-unit punches designed primarily for use in presses or press brakes in place of the usual multiple punching attachment. The accompanying illustration shows a close-up of a single No. 4 unit. The multi-unit punch has the advantage of being readily clamped on any centers in the press. All units are held to a standard so that additional units can be added to the stock whenever the requirements are greater.

Standard Pratt & Whitney or Cleveland punch couplings hold interchangeable punches for any size punch required. The punches are removed simply by unscrewing the coupling and slipping out the punch.



Multi-unit punch designed by Service Machine Co. in range of sizes

Adjustable back gages are provided on the units and adjustable strippers of sturdy construction are supplied. Adapters on the bottom surface of the unit and tongues on the piston can be machined to suit the machine in which they are to be used.

Spring-return units can be supplied where direct connection to the ram of the press is not desired. All sizes and types of units are alike in essential dimensions such as height from bottom to die bushing and overall height, so that different sizes of units can be used alongside each other where smaller holes at closer centers are desired.

• • •

Spray Guns—

Binks Mfg. Co., 3140 Carroll avenue, Chicago, has developed two new spray guns, models 5 and 6. The former is a touch-up and shading gun while the latter, shown herewith, is a combination touch-up and general service gun. These guns have been designed to meet the need of a touch-up gun with an adjustable spray that could be easily adjusted during operation, to produce a spray that can be widened or narrowed as it moved over the surface being finished. This spray adjustment is accomplished by means of a screw on the side just behind the nozzle head.

Binks combination touch-up and general service spray gun

These new developments give a choice of different styles in touch-up guns, the No. 5 being equipped with an overhead trigger and the No. 6 with the conventional pistol grip. The overhead trigger has been curved to fit the index finger making for greater comfort and closer control, which is said to permit a man to spray longer and faster without tiring. Improved atomization blends in the material being sprayed with that already surrounding the spot being touched up. The head has been so designed that maximum efficiency is obtained without in any way obstructing the vision of the user.

• • •

Range Multiplier for Light Meter—

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has introduced a device, shown herewith, for increasing the range of its light meter. It consists of a light absorbing screen which absorbs nine-tenths of the normal light and transmits the other ten per cent to the photocell. To increase the scale range of the instrument to ten times its normal capacity for the purpose of measuring higher light intensities, it is only necessary to clamp this tranlucent screen in front of the exposed surface of the photocell.

Device increases scale range of Westinghouse light meter

The translucent screen is carefully prepared to reduce the amount of light reaching the photocell to one-tenth without producing any change in the color or wavelength of the light transmitted. The material selected for this screen is such as to be independent of the angle of incidence of the light so as to act as a correct multiplier without regard to actual direction of the light source. Thus, it corresponds in effect to that of a lens stop in a camera. When

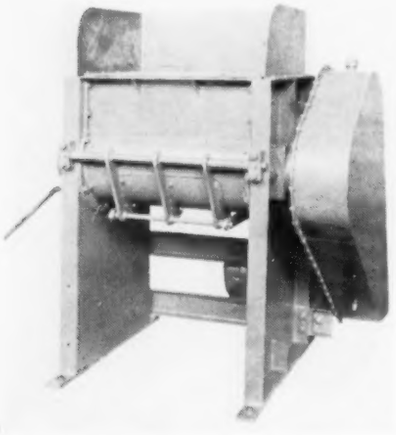
the multiplying device is not in use it conveniently clamps over the base of the light meter.

• • •

Foundry Sand Mixer—

Baker Perkins Co. Inc., Saginaw, Mich., has introduced a foundry sand mixer, as shown in the accompanying illustration. In this machine, specially designed mixing blades rotate in such a way as to push the sand upward. It is claimed that this motion aerates the sand while the down motion rubs the sand along the bottom of the pan.

All gearing is enclosed in sand and dust proof housings. Interchangeable linings and detachable blades used are designed to give maximum



Baker Perkins paddle-type sand mixer is self unloading

wear and to provide easy replacement without dismantling the machine. The sand is discharged through a quick-opening gate while the machine is in motion, the sand being forced through by the sweeping curve of the blade. It is pointed out that this self-discharging design permits rapid changes from facing sands to core sands or the reverse, witb little cleaning.

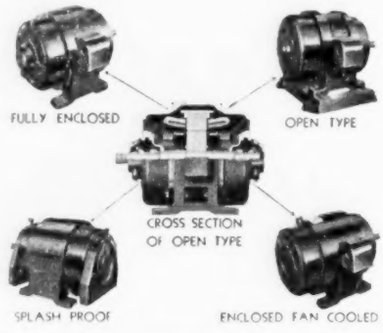
The unit is built in four standard sizes for working capacities of 0.3, 5.5, 13.0, 20.0 cubic feet. The smaller unit is a laboratory machine.

• • •

Convertible Motors—

Harnischfeger Corp., West National avenue, Milwaukee, has announced an entirely new line of convertible squirrel cage and slip ring induction motors, offering all standard frequencies for service ranging from 110 to 220 volts. Built in accordance with the standards adopted by the National Electrical Manufacturers association, the outstanding feature of these new motors, shown herewith, is their ready convertibility from open type to fan cooled, splash proof or totally enclosed construction. This is accomplished through the design of the frame, end heads and bearings to permit interchangeability in the four above mentioned types of single or multi-speed squirrel cage and slip ring motors.

Among the other interesting features is the unique mounting of the



New line of convertible motors announced by Harnischfeger Corp.

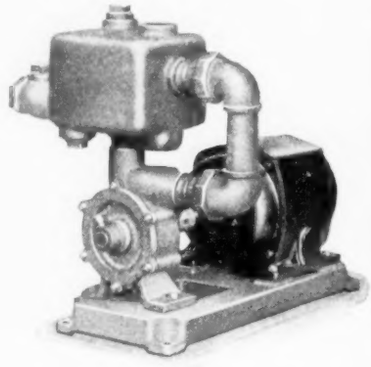
stator laminations which are stacked between heavy steel end rings and the entire assembly then welded to the frame. This construction provides absolute rigidity and makes it impossible for the stator core to shake loose. Rotor windings are assembled from round or rectangular hard drawn copper bars which are placed in the rotor slots without insulation or slot wedges. Ends of the bars are brazed to the end rings by an electric arc torch.

• • •

Volatile Liquid Pumps—

Roots-Connersville Blower Corp., Connersville, Ind., recently introduced a line of volatile liquid pumps which are primarily designed for use in bulk station service, although they are adaptable to several other applications in kindred fields. These units, shown herewith, utilize the standard type "T" turbine pump but are equipped with a priming chamber, including integral by-pass and relief valve, which, according to the company, enables these pumps to handle gasoline satisfactorily even in the hottest summer weather.

An inherent high vacuum readily evacuates long pipe runs, thus facilitating the self-priming of these pumps. Company officials are authority for the statement that tests last summer, when temperatures in tank



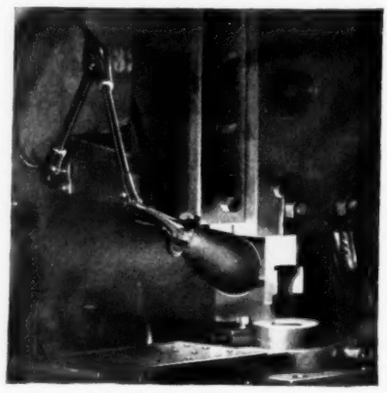
Volatile liquid pump built by Roots-Connersville Corp.

cars frequently exceeded 100 degrees Fahr., proved that even high gravity gasoline can be handled successfully under conditions that are usually considered adverse. These pumps are built in several sizes, ranging from 20 to 350 gallons per minute.

• • •

Industrial Machine Lamp—

Fostoria Pressed Steel Corp., Fostoria, O., recently introduced an industrial machine lamp, shown herewith. The bracket employed is equipped with three ball and socket joints, enabling the machine operator to place the light in any position and still get maximum illumination. The light cord presents no problem because it is contained in the bracket itself, which is made of steel tubing, and because it is so constructed it cannot break at the joints no matter in what position the lamp may be. The light shade, made of aluminum, is of such size, bulbs may be changed without removal of the shade. Moreover, the shade is so shaped that maximum protection is given to bulb.



Industrial machine lamp developed by Fostoria Pressed Steel Corp.

New Trade Publications

GRINDERS—Norton Co., Worcester, Mass., in a current bulletin presents a 6-inch, type C, cylindrical grinder, with illustrations and specifications.

WELDING—Lincoln Electric Co., Cleveland, in its application sheet No. 41, series 2, offers a comparison of designs and costs of machinery bases produced by welding.

GATE VALVES—Fairbanks Co., New York, has published a bulletin on its line of renewable gate valves. Information is given on construction and methods of renewing the valves.

ELECTRIC SWITCH—General Electric Co., Schenectady, N. Y., has issued its bulletin 2023 on its type TC outdoor group-operated switch. Illustrations and diagrams indicate its operation.

FIRE HYDRANT—Western Gas Construction division of Koppers Construction Co., Fort Wayne, Ind., in bulletin No. 307 illustrates its fire hydrant, with diagrams and full description.

DIAMOND TOOLS—Koebel Diamond Tool Co., 1220 Oakman boulevard, Detroit, has issued a primer, answering questions about diamond tools and describing the action of its line, in which small diamonds are used.

PYROMETERS—C. J. Tagliabue Mfg. Co., Brooklyn, N. Y., has published a 16-page catalog, No. 1101, describing its photoelectrically balanced recorders, photoelectric controllers, and light beam indicators.

VALVES—Tuthill Pump Co., 131 West Sixty-third street, Chicago, has issued a folder on its new relief valve for industrial use. Features and advantages are discussed, and illustrations show the construction of the unit.

SEALS—National Motor Bearing Co. Inc., 1100 Seventy-eighth avenue, Oakland, Calif., has published a booklet on its line of oil and fluid seals. Illustrations and text present the construction and application of the seals.

SAND MIXERS—A foundry sand mixer for preparing facing sand or core sand is described and illustrated in a bulletin of the Baker Perkins Co., Saginaw, Mich. Features of design and operation as well as sizes of units available are discussed.

MALLEABLE CASTINGS — Chain Belt Co., 1600 West Bruce street, Milwaukee, published a bulletin discussing its facilities and experience in the production of malleable iron castings. Illustrations show numerous types of castings produced.

TUMBLING MILLS—A bulletin on its counterbalanced roller bearing tumbling mills, in which general specifications of the unit are listed, has been published by the Whiting Corp., Harvey, Ill. Another bulletin covers its turn-tables for shops and yards.

ELECTRODES—A leaflet by Air Reduction Co., Lincoln building, New York, describes its shielded arc electrodes No. 78, 79 and 81. No. 78 is recommended for flat work and No. 79 for vertical and overhead work. No. 81 is a heavily coated electrode for flat welding only.

PARTING — Bloomsbury Graphite Co., Bloomsbury, N. J., has published a bulletin on its liquid parting, sold under the name of Misto. Information is presented on the features of the new material and directions for using are included.

SANDSLINGER—Beardsley & Piper Co., 2541 North Keeler avenue, Chicago, has published a folder on its new swing type sandslinger which provides a flexible molding unit for a wide variety of uses. Drawings show methods of using the equipment.

PROTECTIVE MASKS—Martindale Electric Co., Cleveland, O., has published a folder illustrating the use of its line of protective masks in a wide variety of industries. The mask is designed for protection against dusts, mists and fumes.

DIAMOND WHEELS—Norton Co., Worcester, Mass., has published a booklet covering the story of diamonds in grinding wheels, and discussing the field for diamond wheels manufactured by that company. Information also is presented on how to use the wheels.

HEAT-RESISTANT CASTINGS — Electro Alloys Co., Elyria, O., in a current booklet describes its thermalloy castings, designed for heat and corrosion resistance. The various alloys used for several purposes are described and analyses and physical properties given.

SCREENS—Bulletin No. 93 by the Robins Conveying Belt Co., 15 Park Row, New York, is devoted to description of its vibrating screens for accurate sizing of materials. Illustrations and diagrams show construction and operation and a table of dimensions is included.

PERFORATED METALS—Wickwire Spencer Steel Co., 41 East Forty-second street, New York, has issued a folder illustrating and describing its decorative perforated metals. Various patterns in actual size are shown. Practical uses of this product are listed.

REFRACTORIES—McLeod & Henry Co., Troy, N. Y., has issued a 32-page bulletin on design, installation and service advantages of its carbex and steel mixture bricks and blocks for furnace linings and arches for modern boiler furnaces.

SPRING STEEL—A bulletin by Bethlehem Steel Co., Bethlehem, Pa., covers its silico-manganese spring steel for heavy-duty springs. Explanation of metal fatigue, results of tests and illustrations of various fractures are included.

SAND EQUIPMENT—Harry W. Dietert Co., 676 West Grand boulevard, Detroit, has published several folders on new sand testing equipment, including a sand sample tray, a moisture teller, and a discussion of a mold control formula.

ELECTRODE—Air Reduction Sales Co., 60 East Forty-second street, New York, has published a folder on its shielded arc electrodes. Information includes recommended current values for various positions and reproductions of specimens of welds made with that type of electrode.

FILTRATIONS—Carl Schleicher & Schull Co., 167 East Seventy-third street, New York, has published a second and enlarged edition of "Filtrations in Chemical Laboratories," a handbook on filtering operations for the chemist. An appendix gives large-scale production filtrations in manufacturing plants.

CRANES—Cleveland Crane & Engineering Co., Wickliffe, O., has published a folder on its line of tramrail cranes and transfer bridges. Illustrations show the application of that equipment to a wide variety of industries, including the handling of molten metal in the foundry.

FORGINGS—Kropp Forge Co., 5301 West Roosevelt road, Chicago, has issued a bulletin on its heat-treated forgings, describing its methods of hardening, tempering, normalizing and annealing its forgings to give them properties needed to meet demands of the service for which they are intended.

CONVEYORS — Standard Conveyor Co., Morth St. Paul, Minn., manufacturer of mechanical conveying equipment, has issued a booklet covering installations of its equipment in steel mills and foundries. Presentation is largely by illustrations, with explanation of construction and purpose supplied in the text.

HEAT TREATING — Worthington Pump & Machinery Corp., Harrison, N. J., in its bulletin No. W-1200-B10 presents its drill steel shop equipment, including automatic heat-treating machines and forging furnaces. In bulletin No. S-550-B3A it features its vertical four-cycle gas engines.

WATER COOLING—Binks Mfg. Co., 3106 Carroll avenue, Chicago, offers an 8-page bulletin on indoor forced-draft spray cooling towers, showing features of construction, various installations and size and capacity data. Another bulletin covers atmospheric spray cooling towers for air conditioning and refrigeration, with engineering information and data.

PIPE—Cast Iron Pipe Research association, 122 South Michigan avenue, Chicago, has prepared a booklet entitled "Service Records of Existing Cast Iron Mains Laid in the 17th, 18th and 19th Centuries." The text illustrates early pipe installations in the United States, England, France, Germany. Several installations in American cities have been in use for over 100 years.

HIGH STRENGTH STEELS—A bulletin by Alan Wood Steel Co., Conshohocken, Pa., introduces its new high-strength "70-90" steel in sheets and plates. The bulletin includes a reprint of an article from STEEL, Jan. 21, 1935, on the engineering aspect of high-strength sheet steels and gives answers to 17 questions raised in this article. Stress is placed on the way this company's product meets these problems.

A. I. M. E. Meeting Surveys Recent Metallurgical Developments

(*Concluded from Page* 48)

close to ten billion tons. Mr. Hart said that Cuba had three and a half billion tons of ore on the North coast which runs fairly good in iron but presence of certain elements has restricted its use in this country.

Carl Zapffe, Brainard, Minn., emphasized improvement of methods of handling low-grade ore and scoffed at predictions that the iron ore reserves of the United States would be depleted by 1960. The collective effect of changes in practice in the treatment of ore and the disclosure of new deposits during the past 20 years have indicated that the lake ore region should continue for 121 years and probably longer. He said there is about 1,460,000,000 tons of iron ore in reserve. He thought low consumption since 1929 had extended life of the deposits 10 years.

Discuss Refractories Industries

Refractories industries were discussed in a comprehensive paper by Paul M. Tyler, United States bureau of mines, Washington, and R. P. Heuer, director of research, General Refractories Co., Philadelphia. The authors gave a general description of refractories and outlined their uses. They classified the consumers of refractories as follows: Steel, 50 per cent; public utilties, 20; nonferrous, 6; cement and lime, 5; oil refineries, 4; ceramics and affiliated industries, 3; and miscellaneous, 7 per cent.

The authors described methods of manufacturing fire clay brick, silica brick, magnesite brick, chrome brick, and high alumina brick. They touched upon the history of the refractories industry, declaring that firebrick did not come into general use in the United States until well along in the nineteenth century.

In addition, the authors outlined the organization of the domestic industry and commented upon relatively small imports. As to exports, they said that while there had been some falling off in the foreign movement of fire clay brick, this loss has been made up in recent years to a considerable extent by large exports of magnesite and chrome brick.

SOME observations on sponge iron and properties of direct steel made from it were presented in a paper by R. S. Dean, United States bureau of mines, Washington, and his associates, E. P. Barrett and Calvin Pierson. Their comments dealt chiefly with the structure of sponge iron, of wrought iron made by welding the sponge iron into blooms and of the steel made by melting the forged and rolled blooms. The authors believed that the structure of the final steel is inherited from the ore and that this inherited structure produces marked differences in the properties of the steel.

They described experiments and arrived at the following conclusions: (1) The cell structure of iron ores may be readily determined by studying the structure of sponge iron produced from the ores; (2) wrought iron may be readily made from briquetted sponge iron; (3) the cell structure of sponge iron is present in wrought iron made from the sponge iron; (4) coercive force may be used as an accurate measure of the specific interface in iron or steel; (5) the cell structure in which the slag in the continuous phase is present in metal obtained by melting and casting wrought iron made from sponge iron; and (6) the possibility of producing metal having the merits of both steel and wrought iron is indicated.

New Swedish Sintering Method

Nils K. C. Tholand, president, Ekstrand & Tholand, New York City, cited two instances in which he claimed the substitution of Swedish sponge iron for part of the scrap in the steel charges resulted in a noticeably beneficial influence on the desired properties of the steel made. He indicated that tool steels made from sponge take heat treatments especially well and are tough in the hardened state. He also mentioned what he believed to be certain advantages in the use of sponge iron in steel wire.

Mr. Tholand later described briefly a Swedish sintering method, not heretofore introduced in this country, he said. The principle involves the charging of a mixture of fine ores and fuel on top of a bedding of "returns"; the charge is ignited on the surface and the combustion continues by the downward suction of air. The sintering, he continued, is so handled that the ore particles weaken only on the surface and sinter together where they come into contact, but are never permitted to actually melt.

In discussing a paper by G. B. Waterhouse at the fall meeting and entitled "Manufacture, Properties and Uses of Sponge Iron," Fred Jordan, mining engineer, Youngstown, O., remarked that there is much pessimism concerning the commercial production of sponge iron for purposes other than those which Dr. Waterhouse classed as the chemical field. The latter field, Mr. Jordan stated, is well worth while, but is comparatively small. He contended that at present there is no clearly proven commercial success in the production of sponge iron, and that it had much to overcome to make its use economical and desirable in the usual fields of iron and steel metallurgy.

He believed the sponge iron process is still too costly to compete in the benefication of ores such as are available in this country, and too costly to compete with scrap. Mr. Jordan also claimed that sponge iron has a relatively high content of sulphur and that this is not attractive in view of the demand of users for low sulphur content in steel.

A NEW metal, said to combine the strength and hardness of alloy steels with exceptional resistance to corrosion and heat, was discussed before the institute of metals division by Dr. W. A. Mudge, metallurgist, Huntington, W. Va., works of International Nickel Co., and Dr. Paul D. Merica, assistant to the president of that company. The metal is called "aluminum-monel metal," due, it was said, to the fact that it is much like monel metal with 4 per cent aluminum added. It was stated that this new metal will be especially useful for such applications as turbine blades and pump rods and in general, desirable for installations operating at high temperature, where resistance to corrosion is an important factor.

Service Engineering Helps To Keep Bearings Sold

(*Concluded from Page* 30)

dial bearings may be found where radial-thrust type should be used and, on the other hand, some designers may be prone to install radial-thrust bearings where a pure radial bearing is able to carry the job.

In speaking of the capacity and type of bearing, it is important to remember that trouble cannot be cleared by substituting more bearing capacity if more bearing capacity is not the answer to the problem. This is a frequent case of mis-analyzing a difficulty.

A careful diagnosis of the difficulty makes the remedy obvious. If some specific abnormality has been checked and re-checked as a probable cause, the remedy is its removal. Many times a user assumes that the bearing itself has been the cause of trouble, whereas in a large percentage of the cases the failure of the bearing is only the effect of something else in the mechanism.

Finished Steel Little Affected by Ingot Decline

Rate Down to 50, but Consumer Requirements Are Steady—Heavy Commitments Expected This Week, with Prices Extended—Scrap Index Lower

INDEPENDENT of another decline in steel ingot production last week, 3 points to 50 per cent, demand for merchant pig iron and finished steel still is strong.

Prices on practically all iron and steel products have now been extended for second quarter and this has removed one of the chief uncertainties which led many important consumers to withhold further commitments. A stabilizing influence also has resulted from the gold-clause decision. A heavy tonnage of steel will be enrolled on mill books this week, March 1, for second quarter. Raw steel stocks have been reduced by the temporary slowing in output, and the outlook is appraised by steelmakers as encouraging.

Automobile manufacturers look for an extremely strong retail market for the next four months. They are completing the best February output since 1929, last week's assemblies holding at about 82,000. Considering the numerous mechanical operations on the new models, Ford production activity is probably at an all-time peak. Manufacturers of agricultural implements are second only to the automobile industry in crowding mills for delivery, and expect no slackening in their production for several months.

Payrolls in iron and steel and leading consuming plants are the highest in years, and despite sporadic disturbances at some metalworking establishments serious labor difficulties are not anticipated. The President's proposed extension for two years of NRA evidently does not contemplate any notable change in the steel code.

Mill Equipment Programs To Develop Steel Tonnages; Few Seeking Federal Loans

Miscellaneous requirements for steel appear to be stimulated by demands arising from rehabilitation of equipment in both metal manufacturing and working industries. Of the United States Steel Corp.'s authorized $47,000,000 for new equipment $15,000,000 to $20,000,000 is to be spent in the Gary, Ind., district, and $15,000,000 in the Pittsburgh area. Bethlehem Steel Co. has already contracted for mill equipment as part of its $20,000,000 for Lackawanna, N. Y.

At least one eastern and one middle-western owner of idle iron and steel capacity are seeking government loans to resume operations, one practically assured of $350,000.

Award of 13,376 tons of reinforcing bars last week exceeded structural shapes, 9968 tons. The former included 7030 tons for the Los Angeles metropolitan water district. The district will open bids soon on 15,000 tons of structural shapes for transmission towers, while the Allegheny county authority, Pittsburgh, may purchase 15,000 tons in March for a plaza and bridge, PWA projects. A little more private work is appearing in the shape market. General Motors' diesel locomotive plant in the Chicago district will require 2000 tons.

Pipe Line To Take 9250 Tons of Steel; Railroads Purchasing Track Accessories

The first large bona fide new pipe line project in many months is represented in the bids for Feb. 27 for 9250 tons, an 88-mile line in California, to be laid by the General Petroleum Corp., subsidiary of the Socony-Vacuum Co., New York. Chicago is in the market for 3258 tons of cast pipe. More inquiries for steel barges are turning up at Pittsburgh.

Most railroad activity is in track accessories, Chicago, Burlington & Quincy distributing 8000 tons, Southern Pacific 6000 tons, and Northern Pacific 1860 tons. Southern Railway is inquiring for 2000 tons of fastenings. Central of Georgia purchased 3800 tons of rails. Northeastern of Rio de Janeiro, Brazil, is inquiring for 718 freight cars.

The Carnegie Steel Co. purchased 12,500 tons of No. 1 heavy melting steel scrap at $13, delivered, Munhall, Pa. At Chicago and elsewhere, however, the market is quiet and prices easier, STEEL's scrap composite being down 17 cents to $11.58. German sellers shipped 6500 tons of coke to the New York district, now offered at 50 cents below the domestic market there.

STEEL's London correspondent cables British iron and steel imports in January advanced 14 per cent to 130,544 gross tons, while exports were off 3 per cent to 181,211 tons.

Pittsburgh steelworks operations last week dropped 2 points to 37 per cent; Chicago 10 to 53; Wheeling 2 to 85. Cleveland was up 2 to 79. Detroit held at 100; Buffalo 45; Birmingham 55½; eastern Pennsylvania 31; Youngstown 60; New England 63.

Reflecting the decline in scrap, STEEL's iron and steel price composite is down 4 cents to $32.59. The finished steel index remains $54.

COMPOSITE MARKET AVERAGES

	Feb. 23	Feb. 16	Feb. 9	One Month Ago Jan., 1935	Three Months Ago Nov., 1934	One Year Ago Feb., 1934	Five Years Ago Feb., 1930
Iron and Steel	$32.50	$32.54	$32.56	$32.58	$32.15	$31.30	$34.92
Finished Steel	54.00	54.00	54.00	54.00	54.00	51.10	55.03
Steelworks Scrap....	11.58	11.75	11.65	12.03	9.82	11.72	14.42

Iron and Steel Composite:—Pig iron, scrap, billets, sheet bars, wire rods, tin plate, wire, sheets, plates, shapes, bars, black pipe, rails, alloy steel, hot strip, and cast iron pipe at representative centers. Finished Steel Composite:—Plates, shapes, bars, hot strip, nails, tin plate, pipe. Steelworks Scrap Composite:—Heavy melting steel and compressed sheets.

A COMPARISON OF PRICES

Representative Market Figures for Current Week; Average for Last Month, Three Months and One Year Ago

Finished Material

	Feb. 23, 1935	Jan., 1935	Nov., 1934	Feb., 1934
Steel bars, Pittsburgh	1.80c	1.80c	1.80c	1.75c
Steel bars, Chicago	1.85	1.85	1.85	1.80
Steel bars, Philadelphia	2.09	2.09	2.09	2.04
Iron bars, Terre Haute, Ind.	1.75	1.75	1.75	1.60
Shapes, Pittsburgh	1.80	1.80	1.80	1.70
Shapes, Philadelphia	2.00½	2.00½	2.00½	1.90½
Shapes, Chicago	1.85	1.85	1.85	1.75
Tank plates, Pittsburgh	1.80	1.80	1.80	1.70
Tank plates, Philadelphia	1.98½	1.98½	1.98½	1.88½
Tank plates, Chicago	1.85	1.85	1.85	1.75
Sheets, No. 10, hot rolled, Pitts.	1.85	1.85	1.85	1.75
Sheets, No. 24, hot ann., Pitts.	2.40	2.40	2.40	2.25
Sheets, No. 24, galvan., Pitts.	3.10	3.10	3.10	2.85
Sheets, No. 10 hot rolled, Gary	1.95	1.95	1.95	1.85
Sheets, No. 24, hot anneal., Gary	2.55	2.55	2.55	2.35
Sheets, No. 24, galvan., Gary	3.20	3.20	3.20	2.95
Plain wire, Pittsburgh	2.30	2.30	2.30	2.20
Tin plate, per base box, Pitts.	5.25	5.25	5.25	5.25
Wire nails, Pittsburgh	2.60	2.60	2.60	2.35

Semifinished Material

Sheet bars, open-hearth, Youngs.	$28.00	$28.00	$28.00	$26.00
Sheet bars, open-hearth, Pitts.	28.00	28.00	28.00	26.00
Billets, open-hearth, Pittsburgh	27.00	27.00	27.00	26.00
Wire rods, Pittsburgh	38.00	38.00	38.00	36.00

Pig Iron

	Feb. 23, 1935	Jan., 1935	Nov., 1934	Feb., 1934
Bessemer, del. Pittsburgh	$19.76	$19.76	$19.76	$19.26
Basic, Valley	18.00	18.00	18.00	17.00
Basic, eastern, del. eastern Pa.	19.76	19.76	19.76	18.76
No. 2 foundry, del. Pittsburgh	19.26	19.26	19.26	18.76
No. 2, foundry, Chicago	18.50	18.50	18.50	17.50
Southern No. 2, Birmingham	14.50	14.50	14.50	13.50
No. 2X eastern, del. Philadelphia	20.63	20.63	20.63	19.63
Malleable, Valley	18.50	18.50	18.50	17.50
Malleable, Chicago	18.50	18.50	18.50	17.50
Lake Superior charcoal, del. Chi.	24.04	24.04	24.04	23.54
Ferromanganese, del. Pittsburgh	89.79	18.63	18.63	18.38
Gray forge, del. Pittsburgh	18.63	89.79	89.79	90.24

Scrap

Heavy melting steel, Pittsburgh	$13.25	$13.50	$11.15	$13.90
Heavy melt. steel, No. 2, east. Pa.	9.75	9.95	8.35	9.75
Heavy melting steel, Chicago	11.25	12.15	9.10	10.90
Rails for rolling, Chicago	12.00	12.90	10.35	11.90
Railroad steel specialties, Chicago	12.25	13.40	10.05	12.50

Coke

Connellsville, furnace, ovens	$3.60	$3.60	$3.60	$3.50
Connellsville, foundry, ovens	4.60	4.60	4.60	4.25
Chicago, by-product foundry, del.	9.25	9.25	9.25	9.25

Steel, Iron, Raw Material, Fuel and Metals Prices

Prices are code levels filed with American Iron and Steel Institute, 350 Fifth avenue, New York. Except when otherwise designated, prices are base, f.o.b. cars. Asterisk denotes price change this week.

Sheet Steel

Hot Rolled No. 10, 24-48 in.

Pittsburgh	1.85c
Gary	1.95c
Chicago, delivered	1.98c
New York, del.	2.18c
Philadelphia, del	2.14c
Birmingham	2.00c
St. Louis, del.	2.17c
Pacific ports, f.o.b. cars, dock	2.40c

Hot Rolled Annealed No. 24

Pittsburgh	2.40c
Gary	2.50c
Chicago, delivered	2.53c
Detroit, delivered	2.60c
New York, del.	2.73c
Philadelphia, del.	2.69c
Birmingham	2.55c
St. Louis, del.	2.72c
Pacific ports, f.o.b. cars, dock	3.05c

Galvanized No. 24

Pittsburgh	3.10c
Gary	3.20c
Chicago, delivered	3.23c
Philadelphia, del.	3.39c
New York, del.	3.43c
Birmingham	3.25c
St. Louis, del.	3.42c
Pacific ports, f.o.b. cars, dock	3.70c

Tin Mill Black No. 28

Pittsburgh	2.75c
Gary	2.85c
St. Louis, delivered	3.07c

Cold Rolled No. 10

Pittsburgh	2.50c
Gary	2.60c
Detroit, delivered	2.70c
Philadelphia, del.	2.79c
New York, del.	2.83c
Pacific ports, f.o.b. cars, dock	3.10c

Cold Rolled No. 20

Pittsburgh	2.95c
Gary	3.05c
Detroit, delivered	3.15c
Philadelphia, del.	3.24c
New York, del.	3.28c

Enameling Sheets

Pittsburgh, No. 10	2.50c
Pittsburgh, No. 20	3.10c

Tin and Terne Plate

Gary base, 10 cents higher.

Tin plate, coke base con. (box) Pitts.	$5.25
Do., waste-waste	2.75c
Do., strips	2.50c
Long ternes, No. 24 unassorted, Pitts.	3.40c
Do., Gary	3.50c

Corrosion and Heat-Resistant Alloys

Pittsburgh base, cents per lb.

Chrome-Nickel

	No. 302	No. 304
Bars	23.00	24.00
Plates	26.00	28.00
Sheets	33.00	35.00
Hot strip	20.75	22.75
Cold strip	27.00	29.00

Straight Chromes

	No. 410	No. 430	No. 442	No. 446
Bars	17.00	18.50	21.00	26.00
Plates	20.00	21.50	24.00	29.00
Sheets	25.00	28.00	31.00	35.00
Hot strip	15.75	16.75	21.75	26.75
Cold stp.	20.50	22.00	27.00	35.00

Steel Plates

Pittsburgh	1.80c
New York, del.	2.08c
Philadelphia, del.	1.98½c
Boston, delivered	2.20c
Buffalo, delivered	2.03½c
Chicago or Gary	1.85c
Cleveland, del.	1.98½c
Birmingham	1.95c
Coatesville, base	1.90c
Sparrows Pt., base	1.90c
Pacific ports, f.o.b. cars, dock	2.35c
St. Louis, delivered	2.07c

Structural Shapes

Pittsburgh	1.80c
Philadelphia, del.	2.00½c
New York, del.	2.05½c
Boston, delivered	2.18½c
Bethlehem	1.90c
Chicago	1.85c
Cleveland, del.	1.98½c
Buffalo	1.90c
Gulf Ports	2.20c
Birmingham	1.95c
Pacific ports, f.o.b. cars, dock	2.35c

Bars

Soft Steel

Pittsburgh	1.80c
Chicago or Gary	1.85c
Duluth	1.95c
Birmingham	1.95c
Cleveland	1.85c
Buffalo	1.90c
Detroit, delivered	1.95c
Pacific Coast ports cars, dock, c.i.f.	2.35c
Philadelphia, del.	2.09c
Boston, delivered	2.20c
New York, del.	2.13c
Pitts., forg. qual.	1.95c-2.05c

Rail Steel

To Manufacturing Trade

Pittsburgh	1.70c
Chicago or Gary	1.75c
Moline, Ill.	1.75c
Cleveland	1.75c
Buffalo	1.80c

IRON

Troy, N. Y.	1.70c
Terre Haute, Ind.	1.75c
Chicago	1.80c
Philadelphia	1.89c
Pittsburgh, refined	2.75-7.50c

REINFORCING

New billet, straight lengths, quoted by distributors.

Pittsburgh	2.05c
Chicago, Gary, Buffalo Cleve., Birm., Young	2.10c
Gulf ports	2.45c
Pacific coast ports f.o.b. cars dock	2.45c
Philadelphia, del.	2.34c

Rail Steel

Straight lengths quoted by distributors

Pittsburgh	1.90c
Chicago, Buffalo, Cleveland, Birm., Young	1.95c
Gulf ports	2.30c

Wire Products

(Prices apply to straight or mixed carloads; pool cars, or less, 15c up. 10% dis. on nail extras on straight or mixed carloads to one consignee.)

Base, Pitts.-Cleve. 100 lb. keg

Standard wire nails	$2.60
Cement coated nails	2.60
Galvanized nails, 15 gage and coarser	4.60c
do., 16 gage and finer	5.10c

(Per pound)

Polished staples	3.30c
Galvanized fence staples	3.55c
Barbed wire, galv.	3.00c
Annealed fence wire	2.45c
Galvanized fence wire	2.80c
Woven wire fencing (base column, c.l.)	$63.00
Plain wire, 6-9 gage to mfg. trade	2.30c

Anderson, Ind., (merchant products only) and Chicago up $1; Duluth up $2; Birmingham up $3.

Spring wire, Pittsburgh or Cleveland	2.90c

Do., Chicago up $1, Worcester, $2.

Cold-Finished Carbon Bars and Shafting

Base Pitts., one size, shape, grade, shipment at one time to one destination

10,000 to 19,999 lbs.	2.10c
20,000 to 59,999 lbs.	2.05c
60,000 to 99,999 lbs.	2.00c
100,000 lbs and over	1.97½c

Gary, Ind., Cleveland, up 5c; Buffalo, up 10c; Detroit, up 20c; eastern Michigan, up 25c.

Alloy Steel Bars (Hot)

Pittsburgh, Buffalo, Chicago, Massillon, Canton, Bethlehem 2.45c

S.A.E.	Alloy Diff.	S.A.E.	Alloy Diff.
2000	0.25	3100	0.55
2100	0.55	3200	1.35
2300	1.50	3300	3.80
2500	2.25	3400	3.20
4100	0.15 to 0.25 Mo.		0.50
4600	0.20 to 0.30 Mo. 1.25 1.75 Ni.		1.05
5100	0.80-1.10 Cr		0.45
5100	Cr. spring		base
6100	bars		1.20
6100	spring		0.70
Cr., Ni., Van.			1.50
Carbon Van.			0.95
9250	Carbon base plus extras		

Piling

Pittsburgh	2.15c
Chicago, Buffalo	2.25c

Strip and Hoops

Hot strip to 23½-in. Pittsburgh	1.85c
Chicago, base	1.95c
Birmingham base, Detroit, delivered	2.05c
Phila., delivered	2.14c
New York, del.	2.18c
Cooperage hoop, Pittsburgh	1.95c
Chicago	2.05c
Cold-rolled strip, Pitts., Cleve.	2.60c
Worcester, Mass.	2.80c

Rails, Track Material

(Gross Tons)

Standard rails, mill	$36.37½
Relay rails, Pitts. 24-45 lbs.	$26.00
50-60 lbs.	$23.00
70-75 lbs.	$20.00
80-85 lbs.	$24.00
100 lbs.	$25.00
Light Rails billet qual. Pitts., Chi.	$35.00
Do., reroll. qual.	$34.00
Angle bars, mills	2.55c
Spikes, R. R. base	2.40c
Track bolts, base	3.55c
Tie plates, base	1.90c

Base, light rails 25 to 40 lbs.; 50 to 60 lbs. inclusive up $5; 16 and 20 lbs., up $1; 12 lbs. up $8; 8 and 10 lbs., up $5. Base railroad spikes 200 kegs or more; base tie plates 20 tons.

Bolts and Nuts

Pittsburgh, Cleveland, Birmingham, Chicago. Discounts to legitimate trade for all case lots. Dec. 1, 1932, lists.

CARRIAGE BOLTS

All sizes, cut thread	70-10-10 off
Rolled thread, ½ x 6 and smaller	70-10-10 off

MACHINE BOLTS

All sizes, cut thread lag screws, plow bolts, Nos. 1-2-3-7 heads, tap bolts, blank bolts, stud bolts,	70-10-10 off
Tire bolts	60-10 off
Stove bolts, 75 off in pkgs.; 83 off on 15,000 of 3-inch and shorter, or 5000 over 3-inch	
Rolled thread machine bolts, ½ x 6 and smaller	70-10-10 off
Step bolts	70-10 off
Elevator bolts	70-10 off

NUTS

S.A.E. semifinished hex.; ½ to ⅞-inch	70-10-10 off
Do., ½ to 1-inch	70-10-10 off
Do., over 1-inch	70-10 off

HEXAGON CAP SCREWS

Milled	85 off
Upset, 1-in., smaller	85 off

SQUARE HEAD SET SCREWS

Upset, 1-in. small	70-10 off
Headless set screws	75 off

Rivets, Wrought Washers

Struc., c. l., Pittsburgh, Cleveland	2.90c
Struc., c. l., Chicago	3.00c
⅞-in. and smaller, Pitts., Chi., Cleve.	70 and 5 off
Wrought washers, Pitts., Chi., Phila.	6.25 off

Cut Nails

Cut nails, Pitts.; (10% discount on size extras)	$2.75
Do. less carloads, 5 kegs or more no discount on size extras	$3.05
Do. under 5 kegs; no discount on size extras	$3.20

Pipe and Tubing

Base $200 net ton, except on standard commercial seamless boiler tubes under 2 inches and cold drawn seamless tubing.

Welded Iron, Steel Pipe

Base discounts on steel pipe, Pitts., Lorain, O., to consumers in carloads. Gary, Ind., 2 points less. Chicago delivered 2½ points less. Wrought pipe, Pittsburgh base.

BUTT WELD

Steel

In.	Blk.	Gal.
¼ and ⅜	53½	35
½	58½	47
¾	62	52
1—3	64	55

Iron

½	31½	15
¾	36½	20½
1—1¼	39½	25½
2	41½	26

LAP WELD

Steel

2	60	51
2½—3	63	54
3½—6	65	56
7 and 8	64	54
9 and 10	63½	53½

Iron

2	37	22½
2½—3½	38	25
4—8	40	28½

LINE PIPE

Steel

½, butt weld	57½
⅛-inch, butt weld	50½
¼—⅜, butt weld	52½
¾, butt weld	61
1—3, butt weld	63
2-inch, lap weld	59
2½—3, lap weld	62
3½—6, lap weld	64
7—8, lap weld	63

Iron

⅛—1½ inch, black and galv. take 4 pts, over; 2½—6 inch 2 pts. over discounts for same sizes, standard pipe lists, 8—12-inch, no extra.

BOILER TUBES

C. L. Discounts, f.o.b. Pitts.

Lap Weld Steel		*Charcoal Iron*	
2—2¼	33	1¾	8
2½—2¾	40	2—2¼	13
3	47	2½—2¾	16
3¼—3½	50	3	17
4	52	3¼—3½	18
4½—5	42	4	20
		4½	21

In lots of a carload or more, above discounts subject to preferential of two 5% and one 7½% discount on steel and 10% on charcoal iron.

Lapwelded steel: 200 to 9999 pounds, ten points under base, one 5% and one 7½%. Under 2000 pounds 15 points under base, one 5% and one 7½%. Charcoal iron: 10,000 pounds to carloads, base less 5%; under 10,000 lbs., 2 points under base.

SEAMLESS BOILER TUBES

Under date of May 15 in lots of 40,000 pounds or more for cold-drawn boiler tubes and in lots of 40,000 pounds or feet or more for hot-finished boiler tubes, revised prices are quoted for 55 cold-drawn boiler tube sizes ranging from ¼ to 6-inch outside diameter in 30 wall thicknesses, decimal equivalent from 0.035 to 1.000, on a dollars and cents basis per 100 feet and per pound.

Hot-finished carbon steel boiler tube prices also under date of May 15 range from 1 through 7 inches outside diameter, inclusive, and embrace 47 size classifications in 22 decimal wall thicknesses ranging from 0.109 to 1.000, prices also being on a lb. and 100 ft. basis.

Seamless Tubing

Cold drawn; f.o.b. mill disc.

100 ft. or 150 lbs.	32%
15,000 ft. or 22,500 lbs.	70%

Cast Iron Water Pipe

Class B Pipe—Per Net Ton

6-in. & over, Birm.	$38.00-39.00
4-in., Birmingham	41.00-42.00
4-in., Chicago	49.00-50.00
6 to 24-in., Chicago	46.00-47.00
6-in. & over, east fdy.	42.00
Do., 4-in.	45.00

Class A pipe $3 over Class B. Stnd. fitgs., Birm. base, $100.00

Semifinished Steel

BILLETS AND BLOOMS

4 x 4-inch base; gross ton

Pitts., Chi., Cleve., and Youngstown	$27.00
Philadelphia	32.30
Duluth	31.00
Forging, Pitts., Chi. and Buffalo	32.00
Forging, Duluth	36.00

SHEET BARS

Pitts., Cleve., Young., Chi., Buff., Canton, Sparrows Pt.	28.00

SLABS

Pitts., Cleve., Young.	27.00

WIRE RODS

(Common; combination up $2)

Pitts., Cleveland	38.00
Chicago	39.00
Worcester, Mass.	40.00

SKELP

Pitts., Chi., Young., Buff., Coatesville, Sparrows Point	1.70c

Coke

Price Per Net Ton

BEEHIVE OVENS

Connellsville, fur.	$3.60- 3.85
Connellsville, fdry.	4.60
Connel. prem. fdry.	5.10
New River fdry.	6.00
Wise county fdry.	4.45- 5.25
Wise county fur.	4.00- 4.50

BY-PRODUCT FOUNDRY

Newark, N. J., del.	9.20- 9.65
Chi., ov., outside del.	8.50
Chicago, del.	9.25
New England, del.	11.00
St. Louis, del.	9.25
Birmingham, ovens	6.00
Indianapolis, del.	8.75
Cincinnati, del.	9.30
Cleveland, del.	9.25
Buffalo, ovens	7.50- 8.00
Detroit ov., out. del.	8.50
Philadelphia, del.	9.00

Coke By-Products

Per gallon, producers' plants.

Tank lots	Spot
Pure and 90% benzol	15.00c
Toluol	30.00c
Solvent naphtha	26.00c
Commercial xylol	26.00c

Per lb. f.o.b. New York.

Phenol (200 lb. drums)	16.30c
Do. (100 lbs.)	17.30c

Eastern Plants, per lb.

Naphthalene flakes and balls, in bbls.	5.00c

Per 100 lb. Atlantic seaboard

Sulphate of ammonia	$1.20

†Western prices, ½-cent up.

Pig Iron

Delivered prices include switching charges only as noted. No. 2 foundry is 1.75-2.25 sil.; 25c diff. for each 0.25 sil. above 2.25; 50c diff. for each 0.25 below 1.75. Gross tons.

Basing Points:	No. 2 Fdry.	Malleable	Basic	Bessemer
Bethlehem, Pa.	$19.50	$20.00	$19.00	$20.50
Birdsboro, Po.	19.50	20.00	19.00	20.50
Birmingham, Ala., southern del.	14.50	14.50	13.50	19.00
Buffalo	18.50	19.00	17.50	19.50
Chicago	18.50	18.50	18.00	19.00
Cleveland	18.50	18.50	18.00	19.00
Detroit	18.50	18.50	18.00	19.00
Duluth	19.00	19.00	.....	19.50
Erie, Pa.	18.50	19.00	18.00	19.50
Everett, Mass.	19.50	20.00	19.00	20.50
Granite City, Ill.	18.50	18.50	18.00	.....
Hamilton, O.	18.50	18.50	18.00	19.00
Jackson, O.	20.25	20.25	19.75	.....
Neville Island, Pa.	18.50	18.50	18.00	19.00
Provo, Utah	17.50	.....	17.00	.....
Sharpsville, Pa.	18.50	18.50	18.00	19.00
Sparrows Point, Md.	19.50	.....	19.00	.....
Swedeland, Pa.	19.50	20.00	19.00	20.50
Toledo, O.	18.50	18.50	18.00	19.00
Youngstown, O.	18.50	18.50	18.00	19.00
Delivered from Basing Points:				
Akron, O., from Cleveland	19.76	19.76	19.26	20.26
Baltimore from Birmingham	20.02	.....	19.90	.....
Boston from Birmingham	19.62	.....	19.50	.....
Boston from Everett, Mass.	20.00	20.50	19.50	21.00
Boston from Buffalo	20.00	20.50	19.50	21.00
Brooklyn, N. Y., from Bethlehem	21.77	22.27	.....	.....
Brooklyn, N. Y., from Bmgham.	21.30	.....	.....	.....
Canton, O., from Cleveland	19.76	19.76	19.26	20.26
Chicago from Birmingham	†18.72	.....	18.60	.....
Cincinnati from Hamilton, O.	19.51	19.51	19.01	.....
Cincinnati from Birmingham	19.13	.....	19.01	.....
Cleveland from Birmingham	18.62	.....	18.50	.....
Indianapolis from Hamilton, O.	20.77	20.77	20.27	21.27
Mansfield, O., from Toledo, O.	20.26	20.26	19.76	20.76
Milwaukee from Chicago	19.50	19.50	19.00	20.00
Muskegon, Mich., from Chicago, Toledo or Detroit	21.40	21.40	20.90	21.90
Newark, N. J., from Birmingham	20.51	.....	.....	.....
Newark, N. J., from Bethlehem	20.89	21.39	.....	.....
Philadelphia from Birmingham	19.88	.....	19.76	.....
Philadelphia from Swedeland, Pa.	20.26	20.76	19.76	.....
Pittsburgh district from Neville Island	Neville base plus 63c, 76c and $1.13 switching charges			
Saginaw, Mich., from Detroit	20.60	20.60	20.10	21.10

Delivered from Basing Points:	No. 2 Fdry.	Malleable	Basic	Bessemer
St. Louis from Granite City, Ill.	19.00	19.00	18.50	.....
St. Louis from Birmingham	18.62	.....	18.50	.....
St. Paul from Duluth	20.94	20.94	.....	21.44

†Over 0.70 phos.

Low Phos

Basing Points: Birdsboro and Steelton, Pa., and Standish, N. Y., $23.50. Phila. base, standard and copper bearing, $24.63.

Gray Forge

Valley furnace 18.00
Pitts. dist. fur. 18.00

Charcoal

Lake Superior fur. 21.00
Do., del. Chicago 24.04

Silvery†

Jackson County, O., base; 6% $22.75; 7—$23.75; 8—$24.75; 9—$25.70; 10—$26.75; 11—$27.75. Buffalo base prices, up $1.25.

Bessemer Ferrosilicon†

Jackson County, O., base; 10%—$27.75; 11—$28.75; 12—$30.25; 13—$31.75; 14—$33.25; 15—$34.75; 16—$36.25. Buffalo base prices $1.25 higher.

†The lower all-rail delivered price from Jackson, O., or Buffalo is quoted with freight allowed.

Refractories

Per 1000 f.o.b. Works

Fire Clay Brick

First Quality.

Pa., Ill., Ky., Md., Ga., Mo. $45.00
Alabama 45.00

Second Quality

Pa., Ill., Ky., Md., Mo., Ga., Ala. 40.00

Ohio

First quality $40.00-45.00
Intermediary 37.00
Second quality 28.00

Malleable Bung Brick

All bases 50.00

Silica Brick

Pennsylvania $45.00
Joliet, E. Chicago 54.00
Birmingham, Ala. 52.00

Magnesite

Imported dead-burned grains, net ton f.o.b. Chester, Pa., and Baltimore bases (bags).... $45.00
Domestic dead-burned grains, net ton f.o.b. Chester, Pa., and Baltimore bases (bags).. 40.00
Domestic dead-burned gr. net ton f.o.b. Chewelah, Wash. (bulk).. 22.00

Basic Brick

Net ton, f.o.b. Baltimore, Plymouth Meeting, Chester, Pa.

Magnesite brick $65.00
Chrome brick 45.00
Chemically bonded magnesite 55.00

Fluorspar, 85-5

Washed gravel, duty paid, tide, net ton $19.50
Washed gravel f.o.b. Ill., Ky., net ton, carloads $15.50-16.00

Ferroalloys

Dollars, except Ferrochrome

Ferromanganese, 78-82% tidewater, duty paid 85.00
Do., Balti. base 85.00
Do., del. Pittsburgh 89.79
Spiegeleisen, 19-20% dom. Palmerton, Pa., spot† 26.00
Do., New Orleans 26.00
Ferrosilicon, 50% freight all., cl. 77.50
Do., less carload .. 85.00
Do., 75 per cent .. 126-130.00
Spot, $5 a ton higher.
Silicomang., 2½ carb. 90.00
2% carbon, 95.00; 1%, 105.00
Ferrochrome, 66-70 chromium, 4-6 carbon, cts. lb. con. del. 10.00
Ferrotungsten, stand., lb. cont. del. 1.35- 1.45
Ferrovanadium, 35 to 40% lb., cont., on analysis 2.70- 2.90
Ferrotitanium, c. l., prod. plant, frt. allow., net ton 137.50
Spot, 1 ton, frt. allow., lb. 7.00
do., under 1 ton..... 7.50
Ferrophosphorus, per ton, c. l., 17,-19% Rockdale, Tenn., basis, 18%, $2 unitage 50.00
Ferrophosphorus, electrolytic, per ton c. l., 23-26% f.o.b. Anniston, Ala., 24% $2.75 unitage 65.00
Ferromolybdenum, stand. 55-65%, lb. 0.95
Molybdate, lb. cont. 0.80
†Carloads, Quan. diff. apply.

Nonferrous Prices

METAL PRICES OF THE WEEK

Spot unless otherwise specified. Cents per pound

	Copper: Electro, del. Conn.	Copper: Lake, del. Midwest	Copper: Casting, refinery	Straits Tin: New York Spot	Straits Tin: New York Futures	Lead: N. Y.	Lead: East St. L.	Zinc: St. L.	Aluminum 99%	Antimony: Chinese Spot, N. Y.	Nickel: Cathodes
Feb. 16	9.00	9.12½	7.50	50.05	49.90	3.55	3.40	3.70	*19.00	14.50	35.00
Feb. 18	9.00	9.12½	7.50	50.40	50.20	3.55	3.40	3.70	*19.00	14.50	35.00
Feb. 19	9.00	9.12½	7.50	50.37½	50.05	3.55	3.40	3.70	*19.00	14.50	35.00
Feb. 20	9.00	9.12½	7.50	50.12½	49.00	3.55	3.40	3.70	*19.00	14.50	35.00
Feb. 21	9.00	9.12½	7.50	49.85	49.70	3.55	3.40	3.70	*19.00	14.50	35.00
Feb. 22—Holiday											

*Nominal range 19.00 to 21.00c.

MILL PRODUCTS

F.o.b. mill base, cents per lb. except as specified. Copper, brass products based on 9.00c Conn. copper.

Sheets

Yellow brass (high) 14.25
Copper, hot rolled.... 16.00
Lead, cut, to jobbers 7.25
Zinc, 100-lb. base..... 9.50

Tubes and Pipes

High yellow brass.... 16.00
Seamless copper 16.25

Rods

High yellow brass.... 12.75
Copper, hot rolled 13.25

Anodes

Copper, untrimmed.. 13.75

Wire

Yellow brass (high) 14.75

OLD METALS

Deal. buying prices, cents lb.

No. 1 Composition Red Brass

New York 4.25- 4.50
Chicago 4.37½-4.62½
Cleveland 5.00- 5.25
St. Louis 4.75- 5.00

Heavy Copper and Wire

New York 5.75- 6.00
Chicago, No. 1 ..... 5.50- 5.75
Cleveland 5.50- 5.75
St. Louis 5.25- 5.50

Composition Brass Borings

New York 3.75- 4.00

Light Copper

New York 4.50- 4.75
Chicago 4.25- 4.50
Cleveland 4.75- 5.00
St. Louis 4.75- 5.00

Light Brass

Chicago 2.25- 2.50
Cleveland 2.25- 2.50

Lead

New York 2.70- 2.80
*Cleveland 2.50- 2.75
Chicago 2.50- 2.75
St. Louis 2.65- 2.75

Zinc

New York 1.75- 2.00
Cleveland 1.75- 2.00
St. Louis 2.25- 2.40

Aluminum

*Borings, Cleveland 7.25- 8.00
Mixed, cast, Clev.... 11.50-12.00
Mixed, cast, St. L... 12.75-13.00
*Clips, soft, Clev.... 14.00-14.50

SECONDARY METALS

Brass ingot, 85-5-5-5 8.25
Stand. No. 12 Alum. 16.00-17.00

Iron and Steel Scrap Prices

Corrected to Friday night Gross tons delivered to consumers, except where otherwise stated

HEAVY MELTING STEEL

Birmingham	9.00- 9.50
Boston, dock, expt.	9.00- 9.25
Boston, domestic	7.25- 7.50
Buffalo, No. 1	12.00-12.50
Buffalo, No. 2	10.50-11.00
Chicago, No. 1	11.00-11.50
Cleveland, No. 1	11.00-11.50
Cleveland, No. 2	10.50-11.00
Detroit, No. 1	9.00- 9.50
Detroit, No. 2	8.00- 8.50
Eastern Pa., No. 1	11.00-11.50
Eastern Pa., No. 2	9.50-10.00
Federal, Ill.	8.00- 8.50
Granite City, R. R.	9.50-10.00
Granite City, No. 2	7.25- 7.75
N. Y., deal. No. 2	7.75- 8.00
N. Y., deal. barge	9.25- 9.50
Pittsburgh, No. 1	13.00-13.50
St. Louis	8.25- 8.75
Valleys, No. 1	13.25-13.75

COMPRESSED SHEETS □

Buffalo, dealers	10.50-11.00
Chicago, factory	10.00-10.50
Chicago, dealer	9.50-10.00
Cleveland	11.00-11.50
Detroit	9.00- 9.50
E. Pa., new mat.	10.00-10.50
Pittsburgh	13.00-13.50
St. Louis	7.00- 7.50
Valleys	12.75-13.00

BUNDLED SHEETS □ □

Buffalo	8.50- 9.00
Cincinnati, del.	6.50- 7.00
Cleveland	8.50- 9.00
Pittsburgh	11.50-12.00
St. Louis	5.00- 5.50

SHEET CLIPPINGS, LOOSE □

Chicago	6.00- 6.50
Cincinnati	6.00- 6.50
Detroit	5.00- 5.50
St. Louis	5.00- 5.50

STEEL RAILS, SHORT □

Birmingham	12.00-12.50
Buffalo	13.00-13.50
Chicago (3 ft.)	13.00-13.50
Chicago (2 ft.)	13.75-14.25
Cincinnati, del.	12.00-12.50
Detroit	11.00-11.50
Pitts., open-hearth, 3 ft. and less	14.50-15.00
St. Louis, 2 ft. & less	12.50-13.00

STEEL RAILS, SCRAP □

Boston	7.00- 7.25
Chicago	11.00-11.50
Pittsburgh	13.25-13.75

STOVE PLATE □ □

Birmingham	6.00- 6.50
Boston, dealers	4.00- 4.25
Buffalo	9.25- 9.75
Chicago, net	6.50- 7.00
Cincinnati, dealers	6.00- 6.50
Detroit, net	5.75- 6.25
Eastern Pa.	8.50- 9.00
N. Y., deal. fdry.	6.00
St. Louis	5.50- 6.00

COUPLERS, SPRINGS

Buffalo	13.25-13.75
Chicago, springs	12.00-12.50
Eastern Pa.	14.50-15.00
Pittsburgh	14.50-15.00
St. Louis	10.50-11.00

ANGLE BARS—STEEL □

Chicago	12.00-12.50
St. Louis	11.00-11.50

RAILROAD SPECIALTIES

Chicago	12.00-12.50

LOW PHOSPHORUS

Buffalo, billets and bloom crops	13.25-13.75
Cleveland, billet, bloom crops	15.00-15.50
Eastern Pa., crops	15.00
Pittsburgh, billet, bloom crops	15.00-15.50
Pittsburgh, sheet bar crops	14.00-14.50

FROGS, SWITCHES □ □

Chicago	11.00-11.50
St. Louis, cut	10.50-11.00

SHOVELING STEEL □ □

Chicago	11.00-11.50
Federal, Ill.	8.00- 8.50
Granite City, Ill.	7.50- 8.00

RAILROAD WROUGHT □

Birmingham	7.50- 8.00
Boston, dealers	6.00- 6.50
Buffalo, No. 1	10.00-10.50
Buffalo, No. 2	12.00-12.50
Chicago, No. 1, net	9.75-10.25
Chicago, No. 2	11.50-11.75
Cincinnati, No. 2	8.50- 9.00
Eastern Pa.	11.00-11.50
N. Y., No. 1, deal.	7.50- 8.00
St. Louis, No. 1	7.00- 7.50
St. Louis, No. 2	9.75-10.25

SPECIFICATION PIPE □

Boston	3.00- 3.25
Eastern Pa.	9.50-10.00
New York, dealers	3.50- 4.00

BUSHELING □ □

Buffalo, No. 1	10.50-11.00
Chicago, No. 1	9.50-10.00
Cinci., No. 1, deal.	6.50- 7.00
Cincinnat, No. 2	3.00- 3.50
Cleveland, No. 2	8.00- 8.50
Detroit, No. 1, new	8.00- 8.50
Valleys, new, No. 1	12.50-13.00

MACHINE TURNINGS □

Birmingham	4.50- 5.00
Boston, dealers	3.00- 3.25
Buffalo	6.00- 6.50
Chicago	6.50- 7.00
Cincinnati, dealers	4.00- 4.50
Cleveland	7.50- 8.00
Detroit	4.00- 4.50
Eastern Pa.	6.50- 7.00
New York, dealers	3.00- 3.25
Pittsburgh	8.00- 8.50
St. Louis	3.50- 4.00
Valleys	9.00- 9.50

BORINGS AND TURNINGS □

For Blast Furnace Use

Boston, dealers	3.25- 3.50
Buffalo	6.50- 7.00
Cincinnati, dealers	5.00- 5.50
Cleveland	8.00- 8.50
Detroit	5.50- 6.00
Eastern Pa.	5.00
New York, dealers	1.50- 1.75
Pittsburgh	7.00- 8.00

CAST IRON BORINGS

Birmingham, plain	4.50- 5.00
Boston, chemical	6.00- 7.00
Boston, dealers	3.25- 3.50
Buffalo	6.50- 7.00
Chicago	6.50- 7.00
Cincinnati, dealers	4.00- 4.50
Cleveland	8.00- 8.50
Detroit	5.50- 6.00
E. Pa., chemical	12.00-13.00
New York, dealers	1.50- 1.75
Pittsburgh	7.00- 8.00
St. Louis	3.00- 3.50

PIPE AND FLUES □ □

Cincinnati, dealers	5.00- 5.50

RAILROAD GRATE BARS □

Buffalo	7.00- 7.50
Chicago, net	6.00- 6.50
Cincinnati	4.50- 5.00
Eastern Pa.	9.00
New York, dealers	4.00- 4.50
St. Louis	4.50- 5.00

FORGE FLASHINGS □ □

Boston, dealers	5.50- 6.00
Buffalo	10.50-11.00
Cleveland	9.50-10.00
Detroit	7.50- 8.00

FORGE SCRAP □ □

Boston, dealers	5.50- 6.00
Chicago, heavy	12.00-12.50
Eastern Pa.	10.00

ARCH BARS, TRANSOMS

St. Louis	12.25-12.75

AXLE TURNINGS □ □

Boston, dealers	3.00- 3.50
Buffalo	7.50- 8.00
Chicago, elec. fur.	10.50-11.00
Cleveland	8.00- 8.50
Eastern Pa.	9.50
St. Louis	6.50- 7.00

STEEL CAR AXLES □ □

Birmingham	12.50-13.00
Boston, ship. point.	10.00-10.50
Buffalo	13.25-13.75
Chicago, net	14.50-15.00
Eastern Pa.	16.50-17.00
St. Louis	14.00-14.50

SHAFTING □ □

Boston, ship. point.	12.25-12.50
Eastern Pa.	17.50
New York, dealers	12.50-13.00
St. Louis	11.50-12.00

CAR WHEELS □ □

Birmingham	9.00- 9.50
Boston, iron deal.	6.00- 6.50
Buffalo, iron	11.00-11.50
Buffalo, steel	13.00-13.50
Chicago, iron	11.50-12.00
Chicago, rolled steel	12.00-12.50
Cincinnati, iron	8.50- 9.00
Eastern Pa., iron	10.50-11.00
Eastern Pa., steel	14.50-15.00
Pittsburgh, iron	12.50-13.00
Pittsburgh, steel	14.50-15.00
St. Louis, iron	8.25- 8.75
St. Louis, steel	10.50-11.00

No. 1 CAST SCRAP □ □

Birmingham	9.50-10.00
Boston, No. 1 mach.	8.50- 9.00
Boston, No. 2	7.50
Boston, tex. con.	8.50- 9.00
Buffalo, cupola	10.50-11.00
Buffalo, mach.	11.50-12.00
Chicago, agri. net	8.50- 9.00
Chicago, auto	9.50-10.00
Chicago, mach. net	10.00-10.50
Chicago, railr'd net	9.00- 9.50
Cinci., mach. cup.	9.00- 9.50
Cleveland, cupola	12.50-13.00
Detroit, net	9.50-10.00
Eastern Pa., cupola	11.50-12.00
Pittsburgh, cupola	13.00-13.50
San Francisco, del.	13.50-14.00
Seattle	7.00- 8.50
St. Louis, No. 1	9.00- 9.50
St. L., No. 1 mach.	10.25-10.75

HEAVY CAST □ □

Boston, del.	6.00- 6.25
Buffalo, break.	9.00- 9.50
Cleveland, break.	9.50-10.00
Detroit, auto net	10.50
Detroit, break.	7.00- 7.50
Detroit, auto net	9.50-10.00
Eastern Pa.	11.00
N. Y. break. deal.	6.50- 6.75
Pittsburgh	12.00-12.50

MALLEABLE □ □

Boston, consum.	10.00-10.50
Buffalo	12.50-13.00
Chicago, R. R.	12.50-13.00
Cincinnati, agri. del.	8.75- 9.25
Cleveland, rail	13.00-13.50
Detroit, auto	11.00-11.50
St. Louis, R. R.	10.00-10.50
Eastern Pa., R. R.	11.00-11.50

RAILS FOR ROLLING □

5 feet and over

Birmingham	11.00-11.50
Boston, dealers	8.00- 8.50
Buffalo	12.00-12.50
Chicago	11.75-12.25
Eastern Pa.	12.50-13.00
New York, dealer	7.50- 8.00
St. Louis	10.75-11.25

LOCOMOTIVE TIRES □

Chicago (cut)	12.00-12.50
St. Louis, No. 1	10.00-10.50

LOW PHOS. PUNCHINGS □

Buffalo	13.25-13.75
Chicago	13.00-13.50
Eastern Pa.	14.50-15.00
Pittsburgh	14.50-15.00

Iron Ore

Lake Superior Ore

Gross ton, 51½% Lower Lake Ports

Old range bessemer	$4.80
Mesabi nonbess.	4.50
High phosphorus	4.40
Mesabi bessemer	4.65
Old range nonbes.	4.65

Eastern Local Ores

Cents, unit, del. E. Pa.

Foundry and basic 56-63% con. (nom.)	8.00- 9.00
Cop.-free low phos. 58-60% (nom.)	10.00-10.50

Foreign Ore

Cents per unit, f.a.s. Atlantic ports (nominal)

Foreign manganiferous ore, 45.55% iron, 6-10% man.,	10.00
No. Afr. & low phos.	9.50
Swedish basic, 65%	9.00
Swedish low phos.	9.50
Spanish No. Africa basic, 50 to 60%	9.00
Tungsten, spot, sh. ton unit, duty pd.	$17.75-18.25
N. F. fdy., 55%	7.00
Chrome ore, 48% gross ton, c.i.f.	$18.00-18.50

Manganese Ore

(Nominal)

Prices not including duty, cents per unit cargo lots.

Caucasian, 52-55%	26.00
So. African, 52%	26.00
So. Afr., 49-51%	24.00
Indian, 58-50%	nominal
Indian, 48-50%	nominal

Warehouse Iron and Steel Prices

Cents per pound for delivery within metropolitan districts of cities specified

STEEL BARS	
Baltimore*	2.90c
Boston††	2.95c
Buffalo	3.00c
Chattanooga	3.31c
Chicago	2.95c
Cincinnati	3.15c
Cleveland	2.95c
Detroit	3.03½c
Houston	3.00c
Los Angeles	3.70c
Milwaukee	3.06c
New Orleans	3.30c
New York‡(d)	3.22c
Pittsburgh(h)	2.90c
Philadelphia*	2.90c
San Francisco	3.60c
Seattle	3.60c
St. Louis	3.19c
St. Paul	3.00c
Tulsa	3.25c
IRON BARS	
Portland	3.40c
Chattanooga	3.31c
Baltimore*	3.00c
Chicago	2.75c
Cincinnati	3.15c
New York‡(d)	3.32c
Philadelphia*	2.90c
St. Louis	3.19c
Tulsa	3.25c
REINFORCING BARS	
Buffalo	2.60c
Chattanooga	3.31c
Chicago	2.10c-2.60c
Cleveland (c)	2.10c
Cincinnati	3.25c
Houston	3.25c
Los Ang., cl...	2.15c
New Orleans	3.50c
Pitts., plain(h)	2.05c
Pitts., twisted squares (h)	2.175c
San Francisco	2.45c
Seattle	3.50c
St. Louis	3.24c
Tulsa	3.25c
Young.	2.30c-2.60c
SHAPES	
Baltimore*	2.95c
Boston††	3.17c
Buffalo	3.25c
Chattanooga	3.56c
Chicago	3.20c
Cincinnati	3.40c
Cleveland	3.31c
Detroit	3.40c
Houston	3.00c
Los Angeles	3.70c
Milwaukee	3.31c
New Orleans	3.55c
New York(d)	3.37c
Philadelphia*	2.95c
Pittsburgh(h)	3.15c
Portland	3.55c
San Francisco	3.55c
Seattle	3.55c
St. Louis	3.44c
St. Paul	3.25c
Tulsa	3.50c
PLATES	
Baltimore*	2.95c
Boston††	3.18c
Buffalo	3.37c
Chattanooga	3.56c
Chicago	3.20c
Cincinnati	3.40c
Cleveland, ¼-in. and over	3.31c
Detroit	3.40c
Detroit, ⅜-in.	3.65c
Houston	3.00c
Los Angeles	3.70c
Milwaukee	3.31c
New Orleans	3.55c
New York(d)	3.40c
Philadelphia*	2.95c
Phila. floor	4.95c
Pittsburgh(h)	3.15c
Portland	3.55c
San Francisco	3.55c
Seattle	3.55c
St. Louis	3.44c
St. Paul	3.25c
Tulsa	3.50c
NO. 10 BLUE	
Baltimore*	3.05c
Boston††	3.25c
Buffalo	3.62c
Chattanooga	3.36c
Chicago	3.05c
Cincinnati	3.20c
Cleveland	3.11c
Det., 8-10 ga.	3.13½c
Houston	3.35c
Los Angeles	3.80c
Milwaukee	3.16c
New Orleans	3.55c
New York	3.27c
Portland	3.75c
Philadelphia*	3.05c
Pittsburgh(h)	2.95c
San Francisco	3.75c
Seattle	3.75c
St. Louis	3.29c
St. Paul	3.45c
Tulsa	3.70c
NO. 24 BLACK	
Baltimore*†...	3.51c
Boston (g)	3.90c
Buffalo	3.25c
Chattanooga	4.21c
Chicago	3.85c
Cincinnati	4.05c
Cleveland	3.91c
Detroit	3.98½c
Los Angeles	4.45c
Milwaukee	3.96c
New York	3.85c
Philadelphia*†	3.55c
Pitts.** (h)	3.55c
Portland	4.40c
San Francisco	4.40c
Seattle	4.40c
St. Louis	4.09c
St. Paul	3.695c
Tulsa	4.75c
NO. 24 GALV. SHEETS	
Baltimore*†...	4.21c
Buffalo	4.00c
Boston (g)	4.60c
Chattanooga	4.86c
Chicago (h)	4.55c
Cincinnati	4.70c
Cleveland	4.61c
Detroit	4.70c
Houston	4.40c
Los Angeles	5.05c
Milwaukee	4.66c
New Orleans	4.95c
New York	4.50c
Philadelphia*†	4.25c
Pitts.** (h)	4.15-4.45c
Portland	5.00c
San Francisco	5.00c
Seattle	5.00c
St. Louis	4.79c
St. Paul	4.19c
Tulsa	5.10c
BANDS	
Baltimore*	3.15c
Boston††	3.25c
Buffalo	3.42c
Chattanooga	3.61c
Chicago	3.30c
Cincinnati	3.45c
Cleveland	3.36c
Detroit, ⅜-in. and lighter	3.38½c
Houston	3.25c
Los Angeles	3.90c
Milwaukee	3.41c
New Orleans	3.95c
New York(d)	3.62c
Philadelphia	3.15c
Pittsburgh(h)	3.20c
Portland	3.90c
San Francisco	4.05c
Seattle	3.90c
St. Louis	3.54c
St. Paul	3.20c
Tulsa	3.45c
HOOPS	
Baltimore	2.30c
Boston	4.25c
Buffalo	3.42c
Chicago	3.30c
Cincinnati	3.45c
Det., No. 14 and lighter	3.38½c
Milwaukee	3.41c
New York	3.62c
Philadelphia	3.40c
Pittsburgh(h)	3.70c
Seattle	5.60c
St. Louis	3.54c
St. Paul	3.75c
COLD. FIN. STEEL	
Baltimore (c)	3.71c
Boston	3.85c-4.00c
Buffalo (h)	3.55c
Chattanooga*	4.06c
Chicago (h)	3.50c
Cincinnati	3.70c
Cleveland (h)	3.50c
Detroit	3.63½c
Los Ang.(f)(d)	4.95c
Milwaukee	3.61c
New Orleans	4.30c
New York	3.92c-4.42c
Philadelphia	3.73c
Pittsburgh(h)	3.45c
Portland (f)	4.75c
San Fran.(f)(d)	5.95c
Seattle(f) (d)	4.75c
St. Louis	3.74c
St. Paul	3.20c
Tulsa	4.65c
COLD ROLLED STRIP	
Boston, 0.100-in., 500 lb. lots	5.35c
Buffalo	3.39c
Chicago	3.27c
Cincinnati(b)	3.42c
Cleveland (b)	3.20c
Detroit	3.33c
New York	4.70c
St. Louis	3.36c
TOOL STEELS (Applying on or east of Mississippi river; west of Mississippi 1c up)	Base
High speed	57c
High carbon, high chrome	37c
Oil hardening	22c
Special tool	20c
Extra tool	17c
Regular tool	14c
Uniform extras apply	

(b) Plus straightening, cutting and quantity differentials; (c) Plus mill, size and quantity extras; (d) Minus quant. diff.; (e) New mill classif.; (f) Rounds only; (g) 50 bundles or over; (h) Outside delivery, 10c less.

‡Domestic bars; *Plus quan. extras; **Under 25 bundles; *†50 or more bundles; †New extras apply; ††Base 40,000 lbs. extras on less.

Prices on heavier lines are subject to new quantity differentials; 399 lbs. and less, up 50 cts.; 400 to 9999 lbs., base; 10,000 to 19,999 lbs., 15 cts. under; 20,000 to 39,999 lbs., 25 cts. under; 40,000 lbs. and over, 35 cts. under base.

Current Iron and Steel Prices of Europe

Dollars at Rates of Exchange, Feb. 21

Export Prices f. o. b. Ship at Port of Dispatch—By Cable (or Radio)

	British gross tons U. K. ports		Continental Channel or North Sea ports, metric tons	
			Quoted in dollars at current value	**Quoted in gold pounds sterling
PIG IRON	£ s d			£ s d
Foundry, 2.50-3.00 Silicon	$15.04	3 1 6	$14.18	1 15 0
Basic bessemer	13.45	2 15 0*	12.97	1 12 0
Hematite, Phos. .03-.05	15.28	3 2 6	.....	.....
SEMIFINISHED STEEL				
Billets	$26.90	5 10 0	$19.04	2 7 0
Wire rods, No. 5 gage	38.14	7 16 0	36.49	4 10 0
FINISHED STEEL				
Standard rails	$37.90	7 15 0	$44.60	5 10 0
Merchant bars	1.64c	7 10 0	1.15c to 1.20c	3 2 6 to 3 5 0
Structural shapes	1.61c	7 7 6	1.13c	3 1 6
Plates, †¼ in. or 5 mm	1.74c	8 0 0	1.51c	4 2 6
Sheets, black, 24 gage or 0.5 mm	2.02c	9 5 0	2.13c	5 16 0††
Sheets, gal., 24 gage, corr.	2.45c	11 5 0	2.38c	6 10 0
Bands and strips	1.85c	8 10 0	1.46c	4 0 0
Plain wire, base	2.02c	9 5 0	1.96c	5 7 6
Galvanized wire, base	2.45c	11 5 0	2.30c to 2.33c	6 5 6 to 6 7 6
Wire nails, base	2.61c	12 0 0	2.11c	5 15 0
Tin plate, box 108 lbs.	$ 4.40	0 18 2	.....	.....

British ferromanganese $85 delivered Atlantic seaboard, duty-paid. German ferromanganese £9 0s 0d $43.74) f.o.b.

Domestic Prices at Works or Furnace—Last Reported

	L s d		French Francs		Belgian Francs		Reich Marks
Fdy. pig iron, Si. 2.5	$16.50	3 7 6(a)	$17.21	260	$14.57	310	$24.97	62
Basic bessemer pig iron	16.50	3 7 6(a)*	12.25	185	13.40	285	27.99	69.50
Furnace coke	4.28	0 17 6	7.94	120	5.17	110	7.65	19
Billets	26.90	5 10 0	28.46	430	20.68	440	38.87	96.50
Standard rails	1.80c	8 5 0	2.08c	694	2.31c	1,100	2.42c	132
Merchant bars	1.87c	8 12 0	1.68c	560	1.16c	550	2.01c	110
Structural shapes	1.91c	8 15 0	1.65c	550	1.16c	550	1.97c	107.50
Plates, †¼-in. or 5 mm	1.98c	9 1 3	2.10c	700	1.47c	700	2.32c	127
Sheets, black	2.29c	10 10 0§	2.55c	850‡	1.63c	775‡	2.64c	144‡
Sheets, galv., corr., 24 ga. or 0.5 mm	2.83c	13 0 0	4.05c	1,350	3.15c	1,500	6.77c	370
Plain wire	2.02c	9 5 0	3.15c	1,050	2.31c	1,100	3.17c	173
Bands and strips	2.04c	9 7 0	1.95c	650	1.47c	700	2.32c	127

*Basic. †British ship-plates. Continental, bridge plates. §24 ga. ‡1 to 3 mm. basic price British quotations are for basic open-hearth steel. Continental usually for basic-bessemer steel a del. Middlesbrough. b hematite †† Close annealed

**Gold pound sterling carries a premium of 66.47 per cent over paper sterling.

Bars

Bar Prices, Page 56

Pittsburgh—Carbon steel bars have been reaffirmed at 1.80c, Pittsburgh, and alloy steel bars at 2.45c base, for second quarter. Official declaration confirms opinion held in the trade for some time that no change would be made. Meanwhile, bar specifications are still slack.

Cleveland—Steel bar producers have specifications sufficient to insure a continuation of mill operations and shipments at least at their present level through March. There has been no interruption in business from leading consumers, with about 75 per cent of current output going to automobile manufacturers and forge shops. While the code prohibits acceptance of orders for second quarter before March 1 these interests have been negotiating for material, with the understanding that the orders are to be enrolled on that date. In several important instances larger tonnages have been placed for April delivery. Prices have been reaffirmed for the second quarter.

Chicago—Pressure for steel bar deliveries has slackened, principally by automotive interests. Consumption is holding well, however, and with occasional gains still noted in miscellaneous requirements, the recent letdown is not regarded as indicative of an early decline in general demand. Prices have been extended at present levels into second quarter, though books for that period will not be opened until March 1.

Boston—Commercial steel bar demand is limited to small lots. Forging bars are less active, following the recent slight improvement. Alloy bars move in small lots to machine shops. Bolt and nut makers are not active buyers. The Hartford, Conn., cold-finished mill continues to operate at a fair rate.

New York—Consumers of commercial steel bars are specifying lightly, expecting no change in prices for second quarter. Cold drawn steel still is moving fairly briskly. Commercial bars are 1.80c, Pittsburgh, or 2.13c, New York.

A price of 1.70c, Troy, N. Y., on common iron bars became effective Feb. 24, according to the American Iron and Steel institute. This is an initial filing on this product for this base.

A price of 14.45c on stainless steel forging billets, type No. 426, 10.75c on stainless steel rerolling slabs, type No. 426, and 17c on stainless steel bars, type No. 426, became effective at Pittsburgh, Feb. 14.

Philadelphia—Improved specifications from jobbers brighten the market for steel bars here. Fairly good releases from cold drawers are also being filed. Prices are steady.

Plates

Plate Prices, Page 56

Pittsburgh—The Pittsburgh base price of 1.80c per pound on steel plates has been extended unchanged for second quarter. Plate fabricators are figuring some tank work at Nashville, Tenn., for Gulf Refining Co., Pittsburgh. A Charleston, W. Va., sand and gravel interest has inquiries out for ten barges that will require about 900 tons of plates. A Chicago buyer has an inquiry out for three barges. Heavier coal movement on the three rivers here has brought several coal barge inquiries closer to the contract stage and some coal haulers have found that recalling their chartered barges has not been sufficient to accommodate their needs. Furthermore, several oil concerns, among them Sun Oil Co. and Socony Vacuum Oil Co., are likely barge purchasers. A wrought iron plate and rivet specification has been written into a request for bids on four needle flats to be bought Feb. 28 by the Pittsburgh army engineers.

Cleveland—Plate mill operations here last week were advanced to 50 per cent and improvement appears to be general. Orders are relatively small, but some consumers who have not bought for six months are back in the market, while those who have been taking some material regularly are purchasing larger lots. Demand for the heavier gages is better. Prices have been extended for second quarter.

Chicago—Plate orders are increasing, better demand appearing from miscellaneous users, railroads and equipment builders. Freight car construction continues quiet, but some plate business has developed from work on 1200 cars for the National Railways of Mexico. About 600 tons of plates are involved in tank orders and inquiries for three municipalities.

Boston—Plate orders continue limited to small lots, although such buying has improved slightly. Total volume, however, is barely maintained as several larger consuming industries are inactive, including tank and large steel pipe fabricators and railroads.

New York—Demand for steel plates is quiet again, with pending steel pipe for the water department requiring the largest prospective tonnage.

Philadelphia—Plate tonnage is lagging with little demand from tankmakers or railroads. About 500 tons of plates will be required for a ferry for the Erie, which will be fabricated by the Sun Shipbuilding & Dry Dock Co., Chester, Pa.

San Francisco—The plate market is far from active. Bids have been opened on 700 tons of dredge pipe for the Fort Peck dam, Montana. The Hetch Hetchy pipe line crossing, San Francisco, involving 1500 tons, is the only inquiry of size in California, bids March 6.

Seattle—Puget Sound Machinery Depot, Seattle, was awarded part of the pipe line for Tacoma, Wash., and will fabricate 11,000 feet of 42-inch pipe from 5/16-inch plates, involving 800 tons. Seattle Boiler Works is fabricating over 100 tons, including smoke stacks for the Seattle Gas Co., Willapa Harbor Lumber Co. and a refuse burner in Alaska. Boilers for a cannery at Walla Walla for Libby, McNeil & Libby will be fabricated by C. C. Moore & Co., San Francisco.

Contracts Placed

800 tons, 5/16-inch plates, 41-inch water pipe extension for Tacoma, Wash., to Puget Sound Machinery Depot, Seattle.

100 tons, Seattle Gas Co. improvements, to Seattle Boiler Works, Seattle.

Unstated, boilers for Libby, McNeil & Libby cannery, Walla Walla, Wash., to C. C. Moore & Co., San Francisco.

Unstated tonnage, 100,000-gallon water tank, Uniontown, Ky., to W. E. Caldwell Co., Louisville, Ky.

Contracts Pending

1500 tons, 54-inch welded pipe, Hetch Hetchy pipeline crossing under San Francisco bay; bids March 6.

900 tons, ten sand and gravel barges for Spaff Sand & Gravel Co., Charleston, W. Va.

700 tons, dredge pipe, Fort Peck dam, Montana, bids opened.

500 tons, ferry for Erie railroad, to Sun Shipbuilding & Dry Dock Co., Chester, Pa.

275 tons, tanks, Mattoon, Ill.

213 tons, bureau of supplies and accounts, navy department, Washington, delivery Norfolk, Va., Philadelphia and Brooklyn; 185 tons to Norfolk, Va., under schedule 4329; bids Feb. 26.

175 tons, tanks, Swedeland, Pa.

Unstated, 150-ton sulphite pulp mill, Everett, Wash., for Weyerhaeuser Timber Co.; plans soon.

Unstated tonnage, tank work, Nashville, Tenn., for Gulf Refining Co., Pittsburgh.

Unstated tonnage, four small needle flats, wrought iron plate specification, for army engineers at Pittsburgh; bids Feb. 28.

Unstated tonnage, two 52½ x 14 x 4½-foot dredge tenders; bids March 8 to Vicksburg, Miss., engineers.

Unstated tonnage, one 80 x 24 x 4-foot steel hull survey boat; bids to Kansas City army engineers, March 6.

Sheets

Sheet Prices, Page 56

Pittsburgh—Pittsburgh base prices have been announced for the second quarter as follows: Black sheets, 2.40c; No. 10 gage hot-rolled, 1.85c; galvanized No. 24 gage, 3.10c; and Nos. 10 and 20 gage enameling sheets, 2.50c and 3.10c, respectively. In spite of considerable agitation for advances in cold-rolled sheets, the No. 10 gage base price will be 2.50c, Pittsburgh, and No. 20 gage, 2.95c, Pittsburgh. Demand is still heavy with orders from the agricultural implement makers a feature.

Cleveland—This week, March 1, sheetmakers will place on their books for second quarter a large tonnage for shipment to automobile manufacturers. Though prices for that period are unchanged, the incentive in the case of these consumers is for preferred position. Mills in this district will be booked practically full for March. Demand from the automobile industry is undiminished, and the Cleveland mills and those in an adjacent lake district are continuing to operate at capacity. Orders from refrigerator manufacturers are holding up fairly well, but in other directions tonnage is less.

Chicago—With no signs of a slackening in automotive needs, sheet mills still are busy in attempting to complete shipments against old orders before the end of this quarter, and at the same time to meet desired delivery schedules. Demand among miscellaneous consumers is well maintained, though orders are increasing less rapidly than was true earlier in the year. Present prices are being extended into second quarter. Buyers have little incentive to anticipate future requirements other than a desire to meet production schedules. Needs of farm implement manufacturers appear assured of maintaining recent gains for several months.

Boston—Sheet demand in the New England district is sustained on some finishes, notably blue annealed, but total volume is down slightly. Buying is in small lots. Sheet metal working shops have small stocks.

New York—Postings with the code authority to date indicate no change in sheet prices for second quarter. Among the principal descriptions on which prices have been reaffirmed at Pittsburgh and certain other basing points are galvanized sheets, No. 10 hot rolled, and No. 24 hot rolled annealed. Buying is slower, although sellers are being forced to refuse some business due to inability to make deliveries.

Philadelphia — Sheet producers look for sharp improvement in orders from autobody manufacturers March 1 when they open books for second quarter. Meanwhile, the market is quiet. Prices have been reaffirmed for second quarter.

Buffalo—District sheet mills are operating at 75 per cent, with orders indicating continued production near this point throughout the remainder of the quarter.

Cincinnati—Some sheet producers in this district are unable to accept more orders for delivery this quarter, even though production is close to capacity. Interest is now being shown in early deliveries during the second quarter. Needs for electric refrigerators, an important outlet in this district, are increasing. The American Rolling Mill Co. announced that payrolls at the Zanesville and Middletown, O., plants the past week were the highest in several years, at Zanesville the highest since 1929.

Washington—The Berger Mfg. Co., Canton, O., is low on sheet metal partitions, United States Archives building, Washington, at $545,220, taking a large tonnage of sheets. An alternate on cast metal partitions brought out a low bid of $588,625 by the Art Metal Construction Co., Jamestown, N. Y., the Berger organization not bidding on cast metal. The Art Metal company's bid on sheet metal was $574,969.

St. Louis—Producers and distributors report further improvement in new orders and shipments. Demands are unusually diversified, and miscellaneous requirements are accounting for most of the tonnage.

Transportation

Track Material Prices, Page 57

Most active buying by railroads is in track accessories and considerable tonnage is pending or recently placed. Chicago, Burlington & Quincy is distributing about 8000 tons, for rails it recently placed. Southern Pacific has placed 6000 tons of tie plates with Columbia Steel Co., San Francisco and will soon award 6200 kegs of spikes and 158,000 track bolts. Northern Pacific has placed 4000 kegs of spikes with Pacific Coast Forge Co., Seattle, and 1860 tons of tie plates with Pacific Coast Steel Corp., Seattle. Pere Marquette will take bids Feb. 25 on 200 tons of track fastenings. Southern Railway is inquiring for about 2000 tons of fastenings for the 16,000 tons of rails it recently placed.

Trustees of the Missouri Pacific have been authorized by the United States circuit court to spend $5,584,603 for improvements, largely to track, roadbed, bridges, shops, locomotives and freight cars.

Pending rail inquiry includes 20,000 tons for the New York Central on PWA financing and 2000 tons for the Virginian. Carnegie Steel Co., Pittsburgh, plans resumption of rail rolling at its Edgar Thomson works early in March.

Angle splice bars for rails over 60 pounds per yard have been reduced $5 per ton at Chicago, effective Feb. 21, according to filing with the American Iron and Steel institute, New York. The new price is $2.10 per 100 pounds.

Buses Placed

Mississippi Power & Light Co., Meridian, Miss., 24 passenger buses to Twin Coach Co., Kent, O.

North Shore Bus Co. Inc., Flushing, L. I., fifteen 32-passenger city coaches, to White Motor Co., Cleveland.

Twin City Transit Co., Aberdeen, Wash., two 32-passenger city coaches, to White Motor Co., Cleveland.

Car Orders Placed

Chesapeake & Ohio, five corrosion-resisting steel hopper cars, to Bethlehem Steel Co., Bethlehem, Pa.

Norfolk Southern, two gasoline, mechanical drive, rail motor cars, to American Car & Foundry Co., New York.

Rail Orders Placed

Central of Georgia, 3800 tons, to Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.

Car Orders Pending

Northwest of Brazil, Rio de Janeiro, 718 freight cars of approximately 33 tons capacity, including 300 box, 200 cattle, 150 flat and 68 gondola cars; bids asked.

Shippers Car Line Corp., New York, 10, 25 or 40 forty-ton cars for transporting dry ice; contemplated.

Pipe

Pipe Prices, Page 57

Pittsburgh — General Petroleum Corp., Los Angeles, a subsidiary of Socony-Vacuum Co., New York, is inquiring for 9250 tons of 10¾-inch seamless line pipe for an 88-mile line in California. It is estimated that pipe specified will weigh 40 pounds per foot. Bids are expected to be closed Feb. 27. Last week all pipe producers had signified their second-quarter prices would be unchanged from present discounts on all grades of tubular products, including standard pipe, line pipe, boiler tubes and mechanical tubing.

Chicago—This city is in the market for 3258 tons of 20, 24, 36 and 54-inch pipe, bids closing March 5. This is the largest inquiry to appear in this district in several months. Chicago is also taking bids on 388 tons of 3 to 54-inch pipe. While cast pipe activity remains quiet, or-

ders and inquiries gradually are improving and are expected to continue to increase with the approach of spring. Demand for carload lots shows occasional gains.

Cleveland—Several fairly large cast pipe awards were made in this district during the week, including 420 tons of 8, 12 and 16-inch for Columbus, O. Cleveland opened bids on 200 tons of 60-inch cast pipe. Good shipments of steel pipe are being made for general maintenance work.

New York—Award of close to 4000 tons of cast pipe through contractors for New York city water projects is likely to be delayed for approval of contracts. Almost as much steel pipe also pends for this work and additional bids are being taken this week. Yonkers, N. Y., has closed on 1950 tons with the recent low bidder.

Buffalo—Lively inquiry for pipe is anticipated in the spring months in oil, water and gas construction projects.

San Francisco—Although awards of cast iron pipe are confined to small lots, more than 3000 tons is now pending. So far this year, municipalities have not come into the market for large tonnages.

Seattle—Projects are developing slowly due to lack of funds and immediate demands include only small tonnages. Everett, Wash., is planning a $100,000 extension of 18 and 36-inch mains, filter and settling tanks, to serve a new pulp mill. Aberdeen, Wash., is planning an 8-mile extension of the Wishkah water system.

Cast Pipe Placed

1950 tons, 30-inch and under with fittings, Yonkers, N. Y., to United States Pipe & Foundry Co., Burlington, N. J.

500 tons, Griggsville, Ill., to James B. Clow & Sons, Chicago.

420 tons, 8, 12 and 16-inch, Columbus, O., to James B. Clow & Sons, Chicago.

367 tons, 6 to 12-inch, Redwood City, Calif., to United States Pipe & Foundry Co., Burlington, N. J.

260 tons, San Diego, Calif., to United States Pipe & Foundry Co., Burlington, N. J.

188 tons, 6 to 10-inch, class 150, South Pasadena, Calif., to United States Pipe & Foundry Co., Burlington, N. J.

150 tons, 6 and 8-inch, Adams, Wis., to James B. Clow & Sons, Chicago.

150 tons, 6 and 8-inch, Adams, Wis., to James B. Clow & Sons, Chicago.

Cast Pipe Pending

3258 tons, 20, 24, 36 and 54-inch, Chicago; bids March 5.

466 tons, 4 to 6-inch, class 150, Kanab, Utah; bids in.

388 tons, 3 to 54-inch, Chicago; bids March 1.

324 tons, 4 to 8-inch, Belmont, Calif.; bids in.

304 tons, 2 to 8-inch, class 150, Levan, Utah; bids in.

282 tons, Oakley, Utah; bids soon.

268 tons, 2 to 8-inch, Monroe, Utah, bids in.

200 tons, 60-inch, for easterly sewage disposal plant, Cleveland; Hunkin-Conkey Construction Co., Cleveland, low on general contract.

170 tons, 4 to 6-inch, Victor, Idaho; bids soon.

158 tons, Bloomington, Idaho; bids soon.

133 tons, 16,000 feet of 4, 6 and 8-inch, Ekalaka, Mont.; bids in.

133 tons, 4 to 12-inch, class 150, Santa Barbara, Calif.; American Cast Iron Pipe Co., Birmingham, Ala., low.

123 tons, 2 to 4-inch, Koosharem, Utah; bids in.

100 tons, disposal plant, Burlingame, Calif.; bids in.

Unstated tonnage, 4500 feet of 6 and 8-inch, Marion, Wis.; bids March 1.

Unstated tonnage, 18 and 36-inch, main extension, Everett, Wash.; bids soon.

Unstated tonnage, 5700 feet, 6 and 8-inch, Okanogan, Wash.; bids Mar. 5.

Unstated tonnage, 8-mile extension, Aberdeen, Wash.; plans in preparation.

Steel Pipe Pending

9250 tons, 88 miles of 10¾-inch seamless line pipe, for General Petroleum Corp., Los Angeles, subsidiary of Socony-Vacuum Co.; bids Feb. 27.

PARTNERS with SHAFTING

COLD DRAWN BARS
•
TURNED AND GROUND SHAFTING
•
FREE-CUTTING SCREW STOCK
•
EXTRA WIDE FLATS
•
SPECIAL SECTIONS
•
AND ALLOY STEELS

Specifications and applications of B & L Steel Shafting are shown in the new Folder No. 4-S.

BETTER MADE STEELS LABORATORY TESTED

THE Farmer, the Implement Maker and the Steel Manufacturer are all partners in developing the mechanical efficiency represented in this picture.

The modern corn binder—that cuts, bundles, ties and loads the corn automatically—is typical of today's machinery which has lightened the burdens of yesterday, in field and factory *in every industry*.

Cold Drawn Steel and Shafting are the basic materials that men work with to improve their methods, machines and products—and the better the steel, the better the results!

BLISS & LAUGHLIN, INC.

HARVEY, ILL. *Sales Offices in all Principal Cities* BUFFALO, N.Y.

Shapes

Structural Shape Prices, Page 56

Pittsburgh — Barring unforeseen delays, Allegheny county authority, Pittsburgh, will advertise early in March for bids on the Liberty tubes toll ramp and plaza and the Homestead, Pa., bridge. These two projects, out of a PWA grant of $24,500,000 some months ago, are closest to the inquiry stage, and will involve upwards of 15,000 tons of structural shapes, reinforcing bars and steel piling. Construction work should be underway late in April. The 1.80c per pound base on plain structural shapes has been extended for second quarter.

Cleveland—Several new industrial projects are being considered in this district which may require fairly large tonnages of structural shapes, but these have not yet reached the inquiry stage. Demand for small lots is fairly brisk. Gummed Products Co., Troy, O., has awarded 330 tons for a building at Troy to Ingalls Iron Works Co., Birmingham, Ala.

Chicago — Fabricated structural steel orders and inquiries are slow to improve despite a slight betterment recently in private construction. The largest of the latter is a diesel locomotive plant for a General Motors Corp. subsidiary which will take about 2000 tons of shapes. Inquiries involving lots of more than 100 tons are confined to state bridges and federal buildings. A fairly large tonnage of shapes will be required for a bridge to be built over the Calumet river on Torrence avenue. Plans for the superstructure have yet to be issued.

Boston—Including small awards and a 370-ton bridge at Rumford, Me., structural lettings approximate 500 tons. The bridge award went to a Pittsburgh district shop and New England fabricators have little business. Fresh inquiry is light.

New York—Last of close to 11,000 tons for track depressions and an elevated highway section, west-side, Manhattan, 1400 tons, has been placed with American Bridge Co., Pittsburgh. While pending volume in this district is the largest in many months, one inquiry, part of the needs for the Triboro bridge superstructure, accounts for the bulk of the tonnage, 38,000 tons. Additional school requirements are active.

Philadelphia—Except for formal award of approximately 2000 tons of shapes for the naval aircraft plant here to McClintic-Marshall Corp., Bethlehem, Pa., recently noted as successful bidder, the market is dull. Prices are steady.

San Francisco — The market is more active, over 1200 tons having been placed during the week. The bulk of going business, however, continues to be comprised of federal and state projects. Los Angeles has taken bids on 700 tons for tunnel ribs, and Fresno, Calif., will open bids Feb. 21 for 600 tons for an auditorium.

Seattle—The market shows increased activity, several sizable jobs having been awarded. Star Iron & Steel Co., Tacoma, Wash., took 300 tons for a crane for the Mare Island, Calif., navy yard. McClintic-Marshall Corp., Pittsburgh, has the award for 680 tons for the Flathead river bridge, Montana, and 206 tons for the Kooskia bridge, Idaho.

Shape Contracts Placed

2000 tons, plant, Chicago, Electro-Motive Corp., subsidiary of General Motors Corp., Detroit, to Austin Co., Cleveland.

1400 tons, track depression, New York Central railroad, Fifty-fourth to Sixty-fourth streets, New York, to American Bridge Co., Pittsburgh; Corbetta Construction Co., general contractor.

687 tons, bridge, Flathead county, Montana, to unnamed interest.

505 tons, state bridge SP 920-J, Kerr county, Texas, to Pittsburgh-Des Moines Steel Co., Pittsburgh.

430 tons, state highway bridges, 1022, Brown county, and 1025, Morgan county, Indiana, to Central States Bridge & Structural Co., Indianapolis, Ind.

370 tons, bridge, Rumford, Me., to Pittsburgh-Des Moines Steel Co., Pittsburgh.

355 tons, state bridge NRH 407-D, Beaver county, Oklahoma, to J. B. Klein Iron & Foundry Co., Oklahoma City, Okla.

330 tons, building for Gummed Products Co., Troy, O., to Ingalls Iron Works Co., Birmingham, Ala.

300 tons, bridge, Monterey, Calif., to Pacific Coast Steel Corp., San Francisco.

300 tons, crane for Mare Island Navy Yard, to Star Iron & Steel Co., Tacoma, Wash.

275 tons, state bridge, Naugatuck river, Beacon Falls, Conn., to Lackawanna Steel Construction Corp., Buffalo; M. A. Gammino Construction Co., Providence, R. I., general contractor.

260 tons, smelting plant and tanks, St. Joseph Lead Co., Argentina, to Jones & Laughlin Steel Corp., Pittsburgh.

250 tons, high school, Santa Ana, Calif., to Pacific Coast Steel Corp., San Francisco.

250 tons, Hamilton junior high school, Long Beach, Calif., to Consolidated Steel Corp., Los Angeles.

225 tons, alteration, Polytechnic high school, Los Angeles, to Southwest Welding Co., Los Angeles.

206 tons, bridge at Kooskia, Idaho county, Idaho, to McClintic-Marshall Corp., Bethlehem, Pa.

200 tons, warehouse, Grand Coulee dam, Washington, to American Bridge Co., Pittsburgh.

190 tons, two 150-foot and two 40-foot spans, Dallas county, Iowa, to Des Moines Steel Co., Des Moines.

180 tons, two bridge spans, Humboldt county, Iowa, to Pittsburgh-Des Moines Steel Co., Des Moines.

170 tons, state bridge NRH 513-E, St. Louis county, Missouri, to Stupp Bros. Bridge & Iron Co., St. Louis.

165 tons, switch rack, specification 1582, Los Angeles, to Emsco Derrick & Equipment Co., Los Angeles.

155 tons, state highway bridge, Austin, Ross county, Ohio, to Fort Pitt Bridge Works, Pittsburgh.

150 tons, bridge, Sheridan, Wyo., to Missouri Valley Bridge & Iron Co., Leavenworth, Kans.

140 tons, state bridge NRH 513-A2, St. Charles county, Missouri, to American Bridge Co., Pittsburgh.

140 tons, warehouse for American Potash & Chemical Co., Trona, Calif., to Ingalls Iron Works, Birmingham, Ala.

115 tons, state highway bridge 1002-B, Metter, Ga., to Virginia Bridge & Iron Co., Roanoke, Va.

110 tons, addition, International Harvester Co. tractor plant, Chicago, to Gage Structural Steel Co., Chicago.

110 tons, alteration, Jefferson junior high school, Long Beach, Calif., to Virginia Bridge & Iron Co., Roanoke, Va.

100 tons, joists, high school, Santa Ana, Calif., to unnamed interest.

100 tons, store, Mason City, Iowa, to Des Moines Steel Co., Des Moines, Iowa.

Shape Awards Compared

	Tons
Week ended Feb. 23	**9,968**
Week ended Feb. 16	**12,535**
Week ended Feb. 9	**20,305**
This week in 1934	**13,391**
Weekly average, 1934	**16,284**
Weekly average, 1935	**13,512**
Weekly average, January	**13,660**
Total to date, 1934	**148,638**
Total to date, 1935	**108,097**

Shape Contracts Pending

15,000 tons, transmission towers, metropolitan water district, Los Angeles; bids soon.

850 tons, postoffice, Phoenix, Ariz.; Great Lakes Construction Co., Chicago, low for general contract.

700 tons, tunnel ribs, bids 32267, metropolitan water district, Los Angeles; Consolidated Steel Corp., Los Angeles, low.

600 tons, Timken Roller Bearing Co. plant, Gambrinus, O.; award delayed until late March.

500 tons, bridge, Kerrville, Tex.

500 tons, bridge, New York Central railroad, 171st street, New York; bids Feb. 26.

450 tons, Mount Pleasant school, Providence, R. I.

450 tons, bridge, Champaign county, Illinois; Mississippi Valley Structural Steel Co., Decatur, Ill., low.

300 tons, building, Baltimore, for Levinson & Klein Co., Baltimore.

300 to 600 tons, auditorium, Fresno, Calif.; bids Feb. 21.

270 tons, plate girder span comprised of four 106-foot sections, Mifflin county, Pennsylvania, project; J. L. McIlvain, Chambersburg, Pa., general contractor.

250 tons, 75-ton gantry crane, specification 664-D, Boulder dam, Boulder City, Nev.; bids Feb. 26.

245 tons, hospital, Warm Springs, Mont.; bids soon.

230 tons, Ebey Slough state bridge, Washington; bids in.

200 tons, gallery crane, Boulder dam, Boulder City, Nev., specification 662-

D; bids Feb. 20.
173 tons, 92 tons shapes, 81 tons bars, state highway projects, Mississippi; bids in Feb. 19.
158 tons, high school, Billings, Mont.; bids soon.
150 tons, fabricated material for bridges, Delaware, Lackawanna & Western railroad, delivered, Newark, N. J.; Phoenix Bridge Co., Phoenixville, Pa., low.
150 tons, tramway supports, Alexandria, Ind.
150 tons, junior high school, Cranston, R. I.
143 tons, state bridge in Grand county, Colorado; bids Feb. 18.
133 tons, Moon Lake dam, Utah; T. E. Connolly, San Francisco, low for general contract at $547,221.
107 tons, Burnett school, Los Angeles; bids soon.
100 tons or more, Stephen Foster memorial, University of Pittsburgh; bids Feb. 25.
100 tons, Rhode Island state college, library, Kingston, R. I.
Unstated tonnage, Torrence avenue bridge over Calumet river, Chicago; plans awaited.
Unstated, state grade separation Spokane; bids soon.

Reinforcing

Reinforcing Bar Prices, Page 57

Pittsburgh—New billet steel bar producers have filed on the basis of 2.05c, Pittsburgh, for second quarter, to be quoted by distributors for carload lots of cut length bars. It is understood rail steel bars on the same basis are being extended at 1.90c, Pittsburgh.

Cleveland—General contract bids will be taken shortly on dam projects Nos. 6 and 7 in the Muskingum, Ohio, conservancy district by the United States engineer, Zanesville, O. These two projects will require 1200 tons. Uniform bids, obtained directly by the engineer, last week were rejected. The successful contractors will buy the material. For dam projects Nos. 1, 2, 3 and 4, requiring 1200 tons, the engineer awarded 600 tons to Buffalo Steel Co., Buffalo, and 600 tons to L. B. Foster Co., Pittsburgh. State highway work is developing slowly, a few small lots being figured.

Chicago—An early increase in reinforcing bar orders is anticipated since action is planned to be taken soon on a number of projects involving several thousand tons of bars. These include highway construction as well as other public structures. Illinois will spend about $44,000,000 this year on highway and grade separation work. This sum includes about $33,000,000 of federal funds to be allocated from the work relief fund now pending. Bids on additional work in the Chicago sanitary district have yet to be asked for, with 700 tons pending for one unit for which the general contract has been placed. The Mohawk dam near Warsaw, O., will require 700 tons of bars.

Boston—New inquiry includes 300 tons for a Massachusetts highway section and an outfall sewer at Hartford, Conn. Small lot inquiry steady, but aggregate buying is light.

Award of close to 680 tons for veterans' hospital buildings, Tougas, Me., to the Boston rolling mill is the largest in this district in months.

New York—While a fair volume of reinforcing steel has been figured against general contracts on which bids have been opened, buying is light, totaling several hundred tons,

Concrete Awards Compared

	Tons
Week ended Feb. 23	13,776
Week ended Feb. 16	2,165
Week ended Feb. 9	867
This week in 1934	3,560
Weekly average, 1934	4,084
Weekly average, 1935	5,580
Weekly average, January	3,898
Total to date, 1934	33,126
Total to date, 1935	42,897

WATERBURY FARREL'S

TWO POST OPEN BACK PRESSES

REDUCE TOOL SHEAR

A COMPLETE NEW LINE YOU SHOULD KNOW ABOUT

WRITE FOR CIRCULAR 890-M

The Waterbury Farrel Foundry and Machine Company

Waterbury, Connecticut

OFFICES

CLEVELAND CHICAGO PHILADELPHIA

including 220 tons for track depression work on the west-side, Manhattan, New York. While a small inquiry is out for New Jersey highway work, pending volume for roads is light, bulk of needs being for bridges, piers and schools.

San Francisco — Awards were the largest for any week of the year, totaling 8311 tons. The metropolitan water district, Los Angeles, placed 7030 tons of billet and rail steel with four concerns. To date, this year 21,018 tons have been booked as compared with 11,821 tons in the corresponding period in 1934. New inquiries include 1200 tons for a high school in San Francisco, and close to 500 tons for highway work in several counties in California. The largest pending project involves over 3000 tons for contract No. 15 and No. 15-A, San Francisco-Oakland bay bridge, San Francisco.

Philadelphia—Irwin & Leighton, Philadelphia, have been awarded the general contract for the government barracks at Carlisle, Pa., requiring 230 tons of reinforcing bars, and are expected to place this and 650 tons for the naval aircraft factory here in Philadelphia, shortly.

Seattle — The week's awards totaled 405 tons, of which Pacific Coast Steel Co., Seattle, took 100 tons for state highway work and 100 tons for the Seattle city light building. Northwest Steel Rolling Mills, Seattle, also was awarded 100 tons for the latter project.

Reinforcing Steel Awards

7030 tons, specification 87, metropolitan water district, Los Angeles; allocated as follows: 2450 tons to Truscon Steel Co., Los Angeles; 1800 tons to Soule Steel Co., Los Angeles; 1780 tons to Concrete Engineering Co., Los Angeles, and 1000 tons of rail steel bars to West Virginia Rail Co., Huntington, W. Va.

2100 tons for Cahokia creek diversion canal, East St. Louis, Ill., to Laclede Steel Co., St. Louis.

1200 tons, dams in Muskingum, Ohio, conservancy district; 600 tons to Buffalo Steel Co., Buffalo; 600 tons to L. B. Foster Co., Pittsburgh. Bids on dams Nos. 6 and 7, 1200 tons, rejected, and general contract bids to be taken by United States engineer, Zanesville, O.

680 tons, buildings, veterans' hospital, Tougas, Me., to Northern Steel Co., Boston.

533 tons, high school, Venice, Calif., to Security Materials Co., Los Angeles.

350 tons, subway at Union passenger terminal, Los Angeles, to unnamed interest.

275 tons, Glenn Park school, San Francisco, to Concrete Engineering Co., San Francisco.

220 tons, track depression, New York Central railroad, New York, to Joseph T. Ryerson & Son Inc., New York; P. T. Cox Contracting Co., general contractor.

200 tons, city light building, Seattle, to Northwest Steel Rolling Mills, and Pacific Coast Steel Corp., Seattle.

158 tons, state bridges and highway work in three counties in California, to unnamed interest.

125 tons, sewage disposal plant, Greenfield, Mass., to Truscon Steel Co., Youngstown, O.

105 tons, state bridge, Bitterroot river, Mont., to unstated interest; Colonial Construction Co., Spokane, general contractor.

100 tons, alteration to Polytechnic high school, Los Angeles, to unnamed interest.

100 tons, addition, Jefferson junior high school, Long Beach, Calif., to unnamed interest.

100 tons, Hamilton junior high school, Long Beach, Calif., to unnamed interest.

100 tons, Washington state highway work, to Pacific Coast Steel Corp., Seattle.

Reinforcing Steel Pending

1200 tons, Marina junior high school, San Francisco; bids Feb. 20.

700 tons, Mohawk dam near Warsaw, O.; bids to United States engineer, Zanesville, O., March 19.

435 tons, placing, Moon Lake dam, Utah; T. E. Connolly, San Francisco, low for general contract.

167 tons, state highway projects, Texas; bids in.

418 tons, state highway work in Los Angeles county, California; bids March 14.

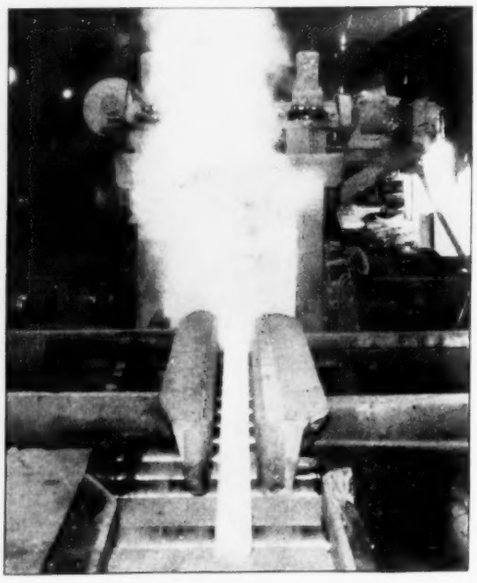
200 tons, hospital, Warm Springs, Mont.; bids soon.

Blood lines, breeding, pedigree—these are readily distinguished in Asco Sepcial High Grade Forging Billets.

There was a time when the quality of a forging billet was determined only after the finished forging had been in use for a period of years. If the forging gave satisfactory service, it was assumed that the forging billet was of high quality.

Blood Lines

Today, however, when you use Asco Forging Billets, you may be assured of the performance of the finished forging in advance of its use, because Asco Special High Grade Forging Billets impart to the finished forging the qualities that make for stamina, durability and longevity that are found to such a high degree in the forging billet.



This in turn means added value to your product, the **extra** quality that distinguishes your forgings from the ordinary kind. Asco Special High Grade Forging Billets are produced for forge shops like yours.

Our Metallurgical Laboratories are at your service in developing special steels for special purposes.

ASCO FORGING BILLETS

THE ANDREWS STEEL CO., NEWPORT, KENTUCKY

Carbon, Chrome, Chrome Molybdenum, Chrome Nickel, Chrome Vanadium, Molybdenum, Nickel, Nickel Molybdenum, Vanadium Billets and Slabs.

170 tons, state highway projects, Louisiana; bids Feb. 27; also 55 tons of structural steel.

165 tons, state highway projects, Tennessee, bids in, also 64 tons of structural steel.

119 tons, seven state bridges, Yuba county, California; bids March 6.

105 tons, shapes and bars, state highway project, Montgomery county, Mississipi; bids in.

100 tons, bridge, Rainier national park, Wash.; Joplin & Eldon, Portland, Oreg., general contractor.

Unstated, reservation hospital, Nespalem, Wash.; J. W. Bailey Construction Co., Seattle, general contractor.

Unstated, seven miles 54-inch concrete water pipe for Tacoma; American Concrete Pipe Co., Tacoma, general contractor.

Unstated, recreation building, veterans' home, Roseburg, Oreg.; bids at Washington, March 19.

Unstated, garage and fire station, Coulee dam, Washington; bids at Almira, Wash., March 4.

Unstated, cannery plant, Montesano, Wash.; bids soon.

Strip Steel

Strip Prices, Page 57

Pittsburgh—Some strip steel buyers last week began to issue temporary hold-ups against commitments made in January. The interruption was not considered serious in view of buyers' promise to lift shipping restrictions within the next ten days. The hot-rolled strip steel market will be unchanged for second quarter at 1.85c, Pittsburgh, as will cold-rolled strip steel at 2.60c, Pittsburgh or Cleveland. According to intentions, producers will open books on this basis March 1.

Cleveland—Strip mills here continue operating at capacity, and representatives of some outside mills report their production increased last week. So far as this quarter is concerned it now is a matter of getting out material for automobile manufacturers on earlier contracts and specifications. A fresh wave of buying is expected when books are opened March 1 at unchanged prices for second quarter. Some fairly good orders were booked during the week from stove and refrigerator manufacturers.

Chicago—Strip mills still encounter difficulty in satisfying consumers as to delivery, and appear assured of active operations through the quarter. Current prices are being extended into second quarter, but this has caused no recession in consumers' demands. Material is moving promptly into consumption and little speculative buying is noted. Automotive requirements disclose no slackening and consumption in miscellaneous industries is well maintained.

Boston—Cold-rolled strip buying, which recently improved has registered no further gains. Building hardware and miscellaneous demand for manufacturing purposes is fairly active. Hot-rolled strip buying is light.

Philadelphia—Prices on cold-rolled strip have been extended to second quarter with similar action expected at once by makers of hot-rolled strip. Little improvement in demand for this material is noted here.

Tin Plate

Tin Plate Prices, Page 56

Pittsburgh—Heavier tin plate specifications came into the market through last week and were sufficient to enable producers to advance their operations both for last week and for the coming week. Last week production schedules went up to 75 per cent, a gain of 5 points; this week they will advance 5 to 80 per cent. The advances were caused chiefly by a leading interest in going to a 15-turn weekly basis in its active divisions. Tin mill sizes of black sheets have been reaffirmed at 2.75c, Pittsburgh, for the second quarter. The $5.25 per base box quotation on standard coke plates continues steady.

"A.W." Super-Diamond
for THE U.S. NAVY
Uncle Sam's "watch dogs" are now using the new "AW" Super-Diamond Pattern! A typical choice—emphasizing the desire to provide the Navy with every safeguard. For "AW" floor plates *are* safe—and permanent.
Be sure your floor plates are really safe—specify "AW" plates. Also available in the reliable standard *Diamond* and *Diamondette* patterns—ferrous and non-ferrous metals.
ALAN WOOD STEEL CO. ESTABLISHED "A.W." TRADE MARK 1826 CONSHOHOCKEN, PA.
SLIP-PROOF • OIL-PROOF
HEAT-PROOF • CRACK-PROOF
SAFE • SIGHTLY • SELF-DRAINING • SPLINTERLESS
109 Years' Iron and Steel Making Experience
ALAN WOOD STEEL CO.
CONSHOHOCKEN, PENNSYLVANIA
Branch Offices: PHILADELPHIA • NEW YORK • SEATTLE
LOS ANGELES • SAN FRANCISCO • MEMPHIS • BOSTON

Wire

Wire Prices, Page 57

Pittsburgh — Plain manufacturing wire, 6-9 gage, at 2.30c, Pittsburgh, spring wire at 2.90c, and standard wire nails at $2.60 per keg, have been reaffirmed for second quarter. Through last week manufacturing wire users seemed less insistent on immediate deliveries but continued to issue specifications for March shipment. The result has been that wire product buying in February will be equal to the showing made in January.

A heavy volume of fencing is being bid to Zanesville, O., army engineers in connection with dam work at Muskingum, O. Edmonds Co., Princeton, W. Va., is low on all three West Virginia state road guard fence projects bid last week, requiring 264,000 lineal feet of fence. Wire rope cable alternate is low on this work. Cyclone Fence Co. last week was awarded two jobs in Pittsburgh, one for Leslie playground at $2306 and the other at $809 for Washington Park playground.

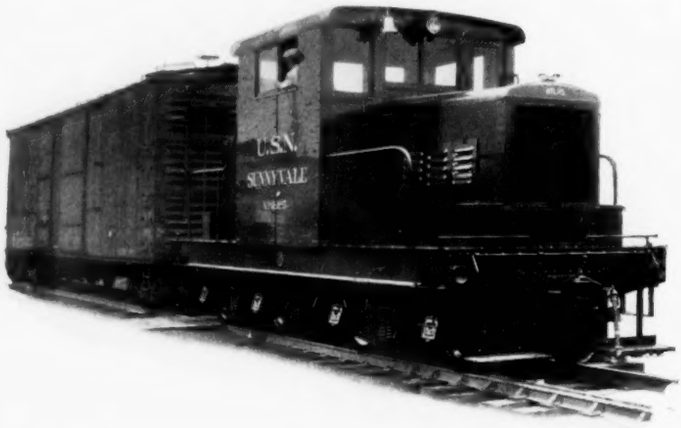
Cleveland—Strikes in three manufacturing plants in this city normally using large quantities of wire have reduced consumption, but excepting this demand still is strong, and production is steady at about 60 per cent. Shipments of farm material are increasing, jobbers stocking up in anticipation of a good season.

Chicago—Wire demand continues active and while there has been a leveling in the rate of business, demand retains the marked gains it has accumulated so far this year. Requirements of the automotive industry remain heavy and no evidence of a letdown is apparent there. Miscellaneous users of manufacturers' wire also are taking material at a steady or better rate, compared with the past several weeks. Indications point to a maintenance of recent demand for the remainder of the quarter.

Boston—Wire mill operations are steady, but new orders are slightly lower. Current demand is for early shipment. Wire for manufacturing purposes holds well and specialties are active, textile industry excepted. Rope and cable demand is limited.

New York—Recently noted price postings on farm and field fence for Pittsburgh, effective Feb. 23, are, in effect, initial filings, for while slightly lower prices had been posted to become effective at Pittsburgh, Feb. 17, they were later withdrawn without becoming operative. The new prices apply to only one type of fence and are not, it is believed, indicative of a trend in wire fence prices generally.

ATLAS GAS-ELECTRIC LOCOMOTIVES



45 Ton Locomotive especially suitable for economical interplant switching service.

OTHER ATLAS PRODUCTS

Gas-Electric and Diesel-Electric Locomotives . . . Electric Transfer Cars for Blast Furnaces and Steel Plants . . . Stockhouse Scale Cars for Blast Furnaces . . . Concentrate and Calcine Cars for Copper Refineries . . . Automatic and Remote Controlled Electric Cars . . . Pushers, Levellers and Door Extractors . . . Coal Charging Lorries, Coke Guides and Clay Carriers . . . Atlas Patented Coke Quenching Cars for By-Product Coke Ovens . . . Atlas Patented Indicating and Recording Scales . . . Special Cars and Electrically Operated Cars for every conceivable Purpose.

THE ATLAS CAR & MFG. CO.

Engineers . . . Manufacturers

CLEVELAND, OHIO

Bolts, Nuts, Rivets

Bolt, Nut, Rivet Prices, Page 57

Producers are extending bolt and nut prices for second quarter. Bolt wire base prices have been reaffirmed without change. The present market is 70-10-10 off list on bolts and nuts, 2.90c, Pittsburgh and Cleveland, and 3.00c, Chicago, on large rivets.

Buying of bolts and nuts in the Pittsburgh district is fairly steady. Cleveland suppliers find demand quiet except from automobile manufacturers. Strikes and threats of strikes in consumer plants in the Cleveland district interfere to some extent with business. Railroad requirements in the Chicago district are light but jobbers are buying fairly well. Farm implement manufacturers are taking steady shipments.

Cold Finished

Cold Finished Prices, Page 57

Pittsburgh—The Pittsburgh base price of 2.10c per pound on carbon cold-drawn bars has been reaffirmed

for the second quarter, according to several producers' price announcements made last week. On cold-drawn carbon bars, basing point differentials were maintained unchanged. At the same time, cold-drawn alloy bars were reaffirmed at 2.95c, Pittsburgh, and all other basing points. Last week, cold-drawn bar orders leveled off in number and volume, thereby arresting a consecutive two-week decline previously. Forecasts favor an improvement in the market early in March when automotive buying is expected to reappear.

Prices have become effective on several new types of stainless steel. Prices on cold-rolled stainless steel were established Feb. 15, on a Pittsburgh base at 20.50c for types No. 411-A and 426 and 22c for type No. 434-A.

Pig Iron

Pig Iron Prices, Page 58

Pittsburgh—District furnaces have announced second quarter prices on the basis of $18 for foundry grades, $18.50 on basic and $19 for bessemer iron. The announcement was discounted generally and failed to create any activity in pig iron demand, excepting negotiations which were underway on a fairly large quarterly requirement for A. M. Byers Co. Only one merchant furnace continues active here, but report is that the Struthers, O., blast furnace, pending a federal loan of $350,000, may resume blast after several years of inactivity. Reciprocity arrangements continue to exert considerable influence in the pig iron market, especially among roll makers. One such recent example has involved the return of considerable scrap at a generous price to the pig iron seller.

Cleveland—With prices pegged for the second quarter, no unusual amount of forward buying is expected when books are opened March 1. Later on a decision by the interstate commerce commission advancing freight rates may stimulate contract bookings. There is a strong impression in the industry that some increase will be allowed, possibly not the full 10 per cent asked for. The gold-clause decision is considered a favorable factor. Orders increased slightly during the week, one interest selling 6000 tons. Shipments of both pig iron and by-product foundry coke continue to gain over the January average.

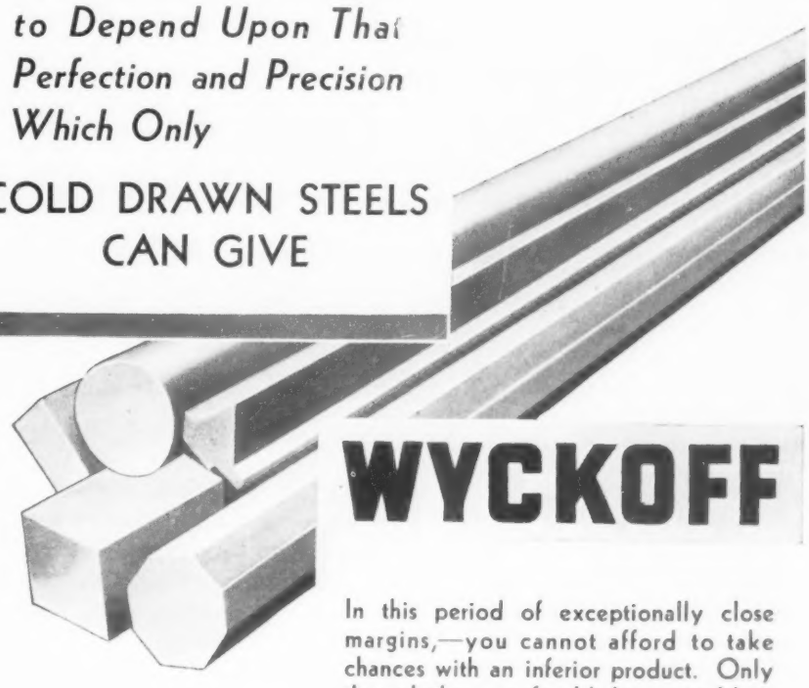
Chicago—Pig iron demand is exceeding expectations and shipments so far this month are over 20 per cent ahead of the corresponding January period. The current market of $18.50, furnace, for No. 2 foundry and malleable has been extended into second quarter, with books to be opened March 1. Pig iron has been moving actively into consumption and shipments are expected to be well maintained throughout the balance of this quarter. Automotive and farm implement foundries are particularly busy and the latter industry is in a comfortable position as regards backlogs to hold to active schedules for the remainder of the first half. Operations of smaller foundries are fairly steady, though the tendency no longer is upward.

Boston—Pig iron imports of 1875 tons in this district during the last 10 days follow absence of arrivals in January. Of this total 1500 tons was Dutch iron, largely for sales from storage; the remainder Indian, most of which has been sold. Total sales are slightly heavier, but still largely in small lots. Prices are firm and unchanged.

New York—With prices being reaffirmed for second quarter, consumers of pig iron continue to buy light-

The Rapid Duplication of Machined Steel Parts at Lowest Cost Continues to Depend Upon That Perfection and Precision Which Only

COLD DRAWN STEELS CAN GIVE



WYCKOFF

In this period of exceptionally close margins,—you cannot afford to take chances with an inferior product. Only through the use of cold drawn steel bars such as are manufactured by this company, can you obtain the increased physical characteristics, exactness to size, straightness and guaranteed machining performance so essential to the maintenance of present-day production costs.

The WYCKOFF organization will welcome an opportunity of cooperating with you, any time,—anywhere.

WYCKOFF DRAWN STEEL COMPANY

GENERAL OFFICES—First National Bank Bldg., Pittsburgh, Pa
MILLS—Ambridge, Penna. and Chicago, Ill.

ly. Volume is perhaps a little improved over a week ago. About 2200 tons of iron will be required for 5000 wheels being ordered for the Interborough Rapid Transit.

Philadelphia—Pig iron sellers report more miscellaneous improvement in buying recently than at any time since the first of the year. Some is said to be attributable to clarification resulting from the gold case decision. Prices are being extended for second quarter.

Buffalo—Pig iron business is gaining ground in a steady market. Foundry operations are on the upgrade and shipments are at a good rate. Large inquiries are lacking but the daily aggregate of business is fair. Five furnaces continue to produce iron with a sixth scheduled before the end of the quarter.

Cincinnati — Furnace representatives expect no rush to cover second quarter pig iron needs, prices being extended. Spot orders are improved slightly, helping to put tonnage for February, even though a shorter month, somewhat above that for January.

St. Louis—Shipments of pig iron to melters are in surprisingly large volume. Total for February to date is slightly more than twice that for all of January. According to sellers, practically all classifications of melters are participating in the movement. Bulk of iron moving consists of foundry grades, but there has been a further increase in shipments of basic grades.

Toronto, Ont.—Pig iron sales largely are confined to single car lots, with occasional orders up to 100 and 200 tons. The daily melt is holding around 40 per cent.

Scrap

Scrap Prices, Page 59

Pittsburgh — Carnegie Steel Co. last week purchased approximately 12,500 tons of No. 1 heavy melting steel at $13 per ton, delivered to its Munhall, Pa., works. Since, other district mills have not joined in purchasing and the market has reverted to its former quiet. However, brokers with short orders are finding difficulty in obtaining coverage below $12.75 on No. 1 heavy melting steel. The market on machine shop turnings has broken $1 a ton to $8 to $8.50, owing to heavy Detroit offerings and a suspension of mill buying at Pittsburgh. A Pittsburgh foundry purchased stove plate last week at $9.50 a ton.

Cleveland—Sales of steel and iron scrap are slow to mature but shipments to melters are fairly steady, except that Youngstown mills have set some embargoes, following heavy deliveries. Prices are weak but unchanged, in absence of sales.

Chicago — Scrap prices have declined 25 cents to $1 a ton, under the influence of light demand and an excess of supplies. Heavy melting steel now is $11 to $11.50, but with mills indicating unwillingness to pay more than $11.25 on new business, lower quotations are regarded as not unlikely. Offerings have been fairly heavy despite sales of only small lots by railroads.

Boston—Scrap buying has subsided and there is less activity for export. The upward trend in prices has also been halted. At docks, dealers are paying $9.25 for No. 1 heavy melting steel and $8.25 for No. 2. At points further inland domestic consumers are meeting this price on wanted material, but are not pressing for shipment.

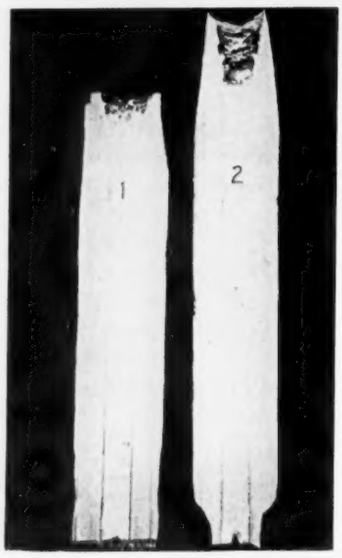
Weakness has developed in skeleton scrap, off 50 cents, while chemical cast borings and forge flashings are also down.

New York — Domestic steel mills are still buying conservatively, although a fair tonnage of breakable cast has been placed for delivery at Harrisburg, Pa., at $11. No. 2 steel scrap is moving to Pencoyd, Pa. at $10, delivered. Some of the material against this buying is coming from Northern New Jersey. With the exception of weakness in turnings, for which there is light demand, prices are steady. Buying for export holds well with dealers paying $9.50, barge, for No. 1 heavy melting steel and $8 for No. 2.

Philadelphia—Weakness is evident in steel and iron scrap, with heavy melting off 50 cents and reductions in several other grades. The changes are largely nominal as little tonnage is moving. A consumer at Bethlehem, Pa., recently bought 2000 tons of prime steel at $11 and slightly less and while this was covered principally from dealers direct some brokers now will take small tonnages at $11, delivered. The leading melter at Coatesville, Pa., is holding up all shipments, one cause of present weakness. Steel continues to move abroad with a Japanese vessel due here soon for loading.

Buffalo—Dealers in this district have sold scrap in tonnage at $12, it is reported, although other sales probably have been made at $11.50 level since. An offer to buy came at a time when the local market appeared headed for the $13 mark. Enough dealers accepted the lower

Let LIQUITOL Reduce YOUR INGOT COSTS



(1) Is treated with LIQUITOL A SPECIAL, the fluid metal is only poured to half of the head. The formation of the hole is such that the ingot is quite solid. The savings in 16 of these ingots is 1 ingot. This is only used for refined steel, that is to say, tool steel, cutting steel, and special steels of high quality.

Liquitol **is a scientifically prepared product resulting in sound Steel or Iron Castings. It retards cooling of hot top metal. Cavities and porosities practically eliminated.**

Does not injure or affect physical or analytical properties of steel or cast iron.

Made in 4 grades for 4 purposes.

Ask for detailed bulletin AL-16-A.

THE ALPHA-LUX COMPANY, INC.

192 Front St.,
NEW YORK CITY

Branches

Philadelphia Chicago

price to force the entire market downward and recovery has not yet begun. It is thought more than 10,000 tons of scrap has been sold this month with more tonnage likely to be contracted soon. A leading melter is offering $11 for steel scrap.

Detroit—High assembly rates at automobile plants are resulting in an increasing flow of scrap. With consuming demand, especially from the Pittsburgh and Youngstown districts, at a low ebb, the inevitable result is a weakening of the price structure. Last week cast borings, busheling, No. 1 and No. 2 melting steel, compressed bundles, stove plate and turnings were down 25 to 50 cents, chiefly the latter. Despite reports to the contrary, only a normal tonnage is on dock awaiting opening of navigation.

Cincinnati—The market for iron and steel scrap, despite recent reductions in dealers' buying prices, continues weak in the absence of mill buying. Shipments on contracts are moving without restriction. Demand here was not sufficient to draw many items on recent railroad lists.

St. Louis—From the standpoint of purchasing by consumers iron and steel scrap continues dull and further softening is evident. With the easing off in prices at Chicago and other points east, the movement of material has shrunk to small proportions. Some dealer buying is in progress, but in smaller volume.

Seattle—The export market is well stabilized at $9.75, gross ton, f.a.s., for No. 1 melting and $11.25 for steel rails. The former is the highest in several years. Japan is hesitating because of exchange uncertainty but sellers are firm in their ideas.

Toronto, Ont.—Trading in iron and steel scrap is increasing. Steel grades now are furnishing most new demand. Heavy melting steel is active but turnings are moving slowly. Foundries are taking cast and wrought scrap.

Semifinished

Semifinished Prices, Page 57

With an advancing rate in tin mill operations, semifinished tin bars are in stronger demand. Despite an effort to advance the price of forging quality bars from $32, base Pittsburgh, this price and other semifinished steels were reaffirmed last week for the second quarter. Thus, $27, Pittsburgh, will be the billet price; $38, the wire rod base; and $28, the sheet bar quotation. Likewise alloy billets at $49, Pittsburgh, alloy uncropped ingots at $40, base, and skelp at 1.70c, all basing points, were extended without change.

Warehouse

Warehouse Prices, Page 60

New York—Warehouse volume has improved slightly with this month slightly above last with most jobbers. Buying is mainly in small lots, but well spread with prices unchanged.

Pittsburgh—Warehouse steel orders are steady at a higher rate than in January. Prices are unchanged.

Cleveland—Tonnage has declined, and for February is below the January daily average. Some sellers note an increase in the number of small orders. Prices are steady.

Chicago—Sales continue slightly ahead of the January rate and are above February, 1934. Business from country districts has increased further and approximates that from the city.

Boston—Warehouse volume has improved slightly, with an increase in small orders. Buying is well spread at unchanged prices. Small shipyard demand is slightly heavier.

Philadelphia—Steel warehouse business is featured by improved demand for sheets, particularly cold-rolled, reflecting the sold condition of mills. This improvement is expected to continue over the remainder of the quarter. Daily average rate of sales in February is below that of January. Prices are steady.

Detroit—Demand for iron and steel out of warehouse is holding at the January level, which in turn was an exceedingly strong month. The number of individual orders also is larger, indicating a wider spread of demand. Prices are steady.

Cincinnati—Sales from warehouse show no marked trend at variance with January business, industrial demand holding fairly steady. Individual orders are keyed to immediate needs.

St. Louis—Business of iron and steel warehousemen during the first three weeks of February is reported measurably larger than for the corresponding periods a month and a year earlier. Industrial needs are responding to seasonal influences and show steady expansion.

Seattle—The jobbing business continues in fair volume, showing an increase over a year ago. All items out of stock are moving freely but in small tonnages. Prices are unchanged and generally maintained.

Edgecomb Steel Corp., Newark, N. J., has been made distributor of Armco stainless steel sheets, plates

FORD
TRIBLOCS AND TROLLEYS
. . . for quick, sure, fast load-lifting!
• Spur gears for speed in going into action and in action! . . . Certified malleable castings, drop forgings and electrically welded high carbon steel chain for surety in action! . . . Ford Triblocs do not creep — they hold the load indefinitely — that's why we say specify and use Ford Triblocs for speed, safety and durability. . . . There are no better chain hoists made than Ford Triblocs — at any price — and they are not expensive. . . . Check over the subject with your jobber's salesman. There are lots of spots where you can use one advantageously. He'll show you.
ACCO
NRA CODE
FORD CHAIN BLOCK CO.
An Associate of the American Chain Company, Inc.
Philadelphia, Pa.
In Business for Your Safety
FORD TRIBLOC
2 TON

and strip for the American Rolling Mill Co., Middletown, O. Stocks of sheets will be carried.

Ferroalloys

Ferroalloy Prices, Page 58

Ferromanganese sellers are expected to open books March 1 for second quarter at the unchanged price of $85, duty paid, Atlantic and Gulf ports. Specifications have fallen from the January peak, but continue in good volume. Other ferroalloy prices are steady.

Metallurgical Coke

Coke Prices, Page 57

Domestic heating coke still provides the more attractive outlets to both beehive and by-product coke oven operators compared with meager tonnage in the metallurgical coke market. Two cargoes of German coke have been landed in the New York district, one of 3000 tons, and the second of 3500 tons. They have been offered in the domestic market there at $6 to $6.25. Previously, western Pennsylvania coke operators had been selling in this market, delivered, at around $6.75 to $6.85 per ton.

The metallurgical coke market on a beehive basis remains quotable, Connellsville, Pa., oven basis, at $3.85 per ton for furnace coke; $4.60 for common grades of foundry coke and $5.10 per ton for premium grades.

Improvement is felt in specifications for by-product foundry coke in the Cincinnati district. St. Louis foundries are taking larger tonnages of metallurgical coke, tonnage exceeding that shipped in January. Chicago foundry coke shipments are larger than in January.

Iron Ore

Iron Ore Prices, Page 59

Cleveland—Producers of Lake Superior iron ore have not yet considered prices for this season, though it generally is believed no change will be made. In one or two instances it has been represented by independent consumers that they might be able to use more ore this year if prices were reduced. This would make the seventh consecutive year for continuation of prices. The Lake Superior Iron Ore association reports:

	Tons
Consumed in December	1,505,751
Consumed in January	2,269,526
Increase in January	763,774
Consumed in January, 1934	1,656,303
On hand at furnaces, Feb. 1, 1935	27,004,379
On Lake Erie docks, Feb. 1, 1935	5,022,889
Total at furnaces and Lake Erie docks, Feb. 1, 1935	32,027,268
Total, Feb. 1, 1934	32,921,799

Coke By-Products

Coke By-Product Prices, Page 57

New York—Distillates are active with some distributors refusing spot business because of inability to ship. Toluol is bought well ahead. Phenol for industrial needs is active. Sulphate of ammonia shipments are steady. Napthalene shipments against contracts have increased slightly.

Nonferrous Metals

Nonferrous Metal Prices, Page 58

New York—Despite a considerable shrinkage in activity in nonferrous metals last week, prices on those domestically produced showed unusual steadiness. President Roosevelt's request that congress renew NIRA for another two years before it expires June 16 caused little stir in the metal trade. He stated that private price fixing must not be condoned but that certain natural resources require government supervision to prevent ruinous price cutting.

Copper—Sales dropped off sharply Monday and Tuesday to less than 1000 tons each but increased again Wednesday to nearly 1500 tons. During the previous week sales totaled 9327 tons and amounted to over 2000 on three successive days. Total for the month through the twentieth was 21,779 tons, leaving an average of about 1500 tons to be sold daily for the balance of the month if the normal book of 30,750 tons is to be sold. Casting copper was firmer at 7.50c, refinery, and a price rise may develop shortly. Electrolytic held at 9.00c, Connecticut, while export copper eased to around 6.65c, c.i.f.

Zinc—Market was extremely quiet but sales of prime western were all made at 3.70c, East St. Louis. Negotiations which are being conducted to curtail production was an important factor in supporting prices.

Lead—By midweek some sellers were able to balance ore intakes but total sales for the week were light. Possibility of a price decline, however, appears remote and the market was firm at 3.55c, New York, with one large seller asking $1 premium on that basis.

Tin—Fluctuations in Sterling exchange were reflected in the Straits market and after advancing to 50.40c, New York, the price settled to below the 50-cent level toward the end of the week. Supplies of spot metal continue tight and this acute situation will likely continue for some time.

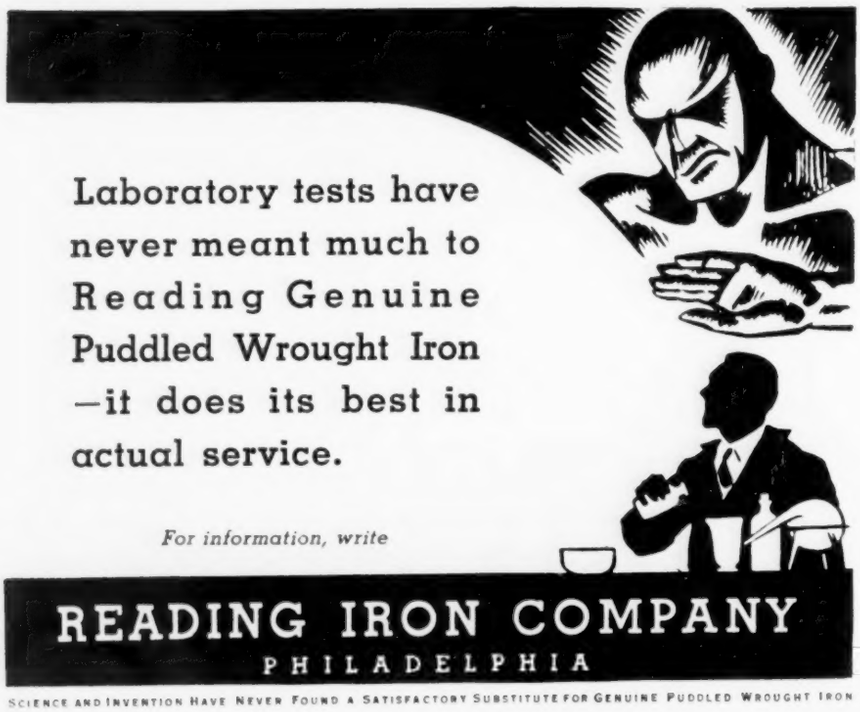
Antimony—Demand was confined to less than carlots but prices again were unchanged at 14.50c, duty paid, for Chinese futures.

Aluminum—Demand was reported in fair volume with prices unchanged.

Steel in Europe

Foreign Steel Prices, Page 60

London—(*By Radio*)—Imports of iron and steel products into Great


Laboratory tests have never meant much to Reading Genuine Puddled Wrought Iron —it does its best in actual service.
For information, write
READING IRON COMPANY
PHILADELPHIA
SCIENCE AND INVENTION HAVE NEVER FOUND A SATISFACTORY SUBSTITUTE FOR GENUINE PUDDLED WROUGHT IRON

Britain in January increased 16,046 gross tons, from 114,498 tons in December to 130,544 tons. Exports declined 5613 tons, from 186,824 tons in December to 181,211 tons.

Principal British pig iron consumers are covered well ahead, some to the end of June. Spot business also is being placed. A shipment of 1000 tons of ferromanganese has been made to Australia. The domestic market for semifinished steel is more active as foreign competition has lessened. The steel trade generally is busy and current exports are expanding. Dorman, Long & Co. has booked a contract for a bridge in China. Tin plate and galvanized sheets are quiet.

Reports from the Continent are that export trade is dull, but Germany has booked some orders for steel from the Far East.

Institute

(*Concluded from Page* 12)

limited to a Pacific coast state; now it is any state.

AIR-CONDITIONING USE BIG

Over 600,000 tons of steel has been used to date in air-conditioning equipment, and large future consumption of steel for this purpose is in prospect, according to the Institute.

In 1934 installations of air-conditioning equipment are estimated to have consumed 28,000 tons. Within the next ten years it is believed that 450,000 tons of steel a year will be utilized by this industry.

Chief steel products used by the air-conditioning industry are copper-bearing, painted or galvanized sheets, pipe, and light shapes.

FARM MARKET LARGER

The Institute last week also estimated that demand for steel for agricultural uses, at approximately 1,400,000 tons, was the largest since 1929. Chief outlets for steel on the farm are implements, windmills, fencing, bale ties, roofing sheets, eaves troughs and gutters, culverts, water troughs and tanks, barns, silos and small buildings.

NRA

SCRAP iron code authority has set up four new local compliance boards for the following districts: Connecticut, Nathan Katz, of Jacob A. Katz & Sons, Hartford, chairman; Wisconsin, I. Cohen, of Cohen Iron & Metal Co., Milwaukee, chairman; Minnesota, G. W. Landy, Peoples Iron & Metal Co., Minneapolis, chairman; California, Oliver Goldblatt, of R. Rosenberg & Sons, Sacramento, chairman.

OBJECT TO WOOD ON PWA

Code authority of the wholesale hardware trade, Philadelphia, is urging the trade to protest the appointment of Gen. R. E. Wood, president of Sears, Roebuck & Co., Chicago, as head of an advisory committee to assist in allocating the $4,800,000,000 work relief fund of the President. This is an outbreak of differences between wholesale and independent retailers and the chain stores and mail order houses.

GO ON STEEL IMPORT BODY

W. D. Thomas, of Sandvik Steel Inc., New York, has been recognized by NRA as a member of the importers code authority representing the fine steel division. William Manealoff, of Manealoff & Co. Inc., also of New York, will represent the general steel division on the authority. George Scheer, of the George Scheer Co., New York, will represent the machinery division.

NRA LAST WEEK:

Approved an amendment to the manganese code permitting a maximum 48-hour week for hoist, pump and power house men.

Approved an amendment to the code for the metal safety tread manufacturing industry, including a system of open price filing.

Received an amendment to the code for the railway car building industry prohibiting allowances off base prices except for specialties furnished by the customer.

Extended the aluminum code 45 days from Feb. 21.

Financial

FOLLANSBEE BROS. CO. trustees were authorized in federal court at Pittsburgh, Feb. 20, to borrow up to $500,000 against trustees' certificates. Trustees John Follansbee, George T. Ladd and Isaac M. Scott, who were so authorized, will issue certificates in multiples of $1000, to mature at their discretion but not later than Dec. 31, 1935. Interest is fixed at 5 per cent. It is expected that funds will be used for working capital in connection with reopening of the company's Toronto, O., plant in March.

FINANCIAL STATEMENTS

McKeesport Tin Plate Co., McKeesport, Pa., 1934, net of $1,859,339; 1933, net of $1,888,416.

Blaw-Knox Co., Pittsburgh, 1934, net of $35,504; 1933, profit of $111,666.

Continental Steel Corp., Kokomo,

CROSBY STAMPINGS

Since 1896 the Crosby plant has been devoted, exclusively, to designing and producing Sheet Metal Stampings. Avail yourself of this experience. Send us your next stamping problem and watch results.

Manufacturers IDEAL TROLLEY WHEELS

THE CROSBY COMPANY

BUFFALO, N. Y.

Branch Offices

New York, Philadelphia, Pittsburgh, Cleveland, Detroit, Chicago.

Ind., last half of 1934, loss of $240,922; last half of 1933, net of $23,889.

Armstrong Cork Products Co., Lancaster, Pa., 1934, net of $1,973,098; 1933, net of $2,386,715.

Molybdenum Corp. of America, Pittsburgh, 1934, net of $379,006; 1933, net of $180,356.

Midvale Co., Philadelphia, 1934, net of $632,591; 1933, net of $28,349.

Pittsburgh Screw & Bolt Corp., Pittsburgh, 1934, profit of $203,147; 1933, loss of $143,700.

Consolidated Steel Corp., Los Angeles, 1934, operating profit of $11,608, before charges; 1933, operating loss of $116,808.

Mesta Machine Co., Pittsburgh, unchanged 37½-cent common dividend, payable April 1 to record of March 16.

Labor

COST of living of wage earners advanced 1 point from December to January, reaching 81.6 per cent of the 1923 level in the latter month, according to the National Industrial Conference board, New York. Stated another way, the purchasing value of the dollar in terms of necessities was 122.5 cents in January, compared with 123.8 cents in December, on the basis of 1923 parity.

BETHLEHEM SHIP WINS

National labor relations board last week denied petition of the marine and shipbuilding workers union at the Fore river plant of the Bethlehem Shipbuilding Corp., Quincy, Mass., for an election. It also decided that the union affiliation of three men had nothing to do with their layoff.

EVEN STRIKE AT SAFETY!

The middle of last week some 3000 miners at Vesta Coal Co.'s mines near Pittsburgh balked at a compulsory company order to wear safety glasses at all times when on duty. Their first move was to strike, but the company, a subsidiary of Jones & Laughlin Steel Corp., quickly countered by closing the mines. In two days time, however, Patrick P. Fagan, president of United Mine Workers No. 5, telegraphed the group to return to work, the 3000-odd acceded, the mines were reopened and total time lost was less than three days.

Activities of Steel Users and Makers

NATIONAL ELECTRIC FURNACE CORP., Ambridge, Pa., has been sold by the Phelps Dodge Corp., New York, to William C. Robinson, Pittsburgh, and associates. Mr. Robinson had sold the company to Phelps Dodge Corp. in October, 1930. Assets are set at about $10,000,000. Its products include steel, nonferrous and nonmetallic conduit, copper wire, rubber covered wire and brass and copper wire rods. National Electric Products Corp. was formed in April, 1928, by merger of National Metal Molding Co., American Copper Products Corp. and British-American Metal Co. After acquisition by the Phelps Dodge interests this merger was separated into two divisions, Mr. Robinson becoming manager of one, which included practically his old concern, National Metal Molding Co. By the present deal this now reverts to its original ownership.

□ □ □

Vlchek Tool Co., Cleveland, manufacturer of automotive hand tools, is celebrating the fortieth anniversary of its founding. Frank J. Vlchek, its founder, was an immigrant of 17 years when he came to this country from what is now Czecho-Slovakia and after working as a blacksmith opened his own shop and started the manufacture of tools. The plant is run on a profit-sharing basis, profits being divided among employes each year after stock dividends are paid.

Equipment

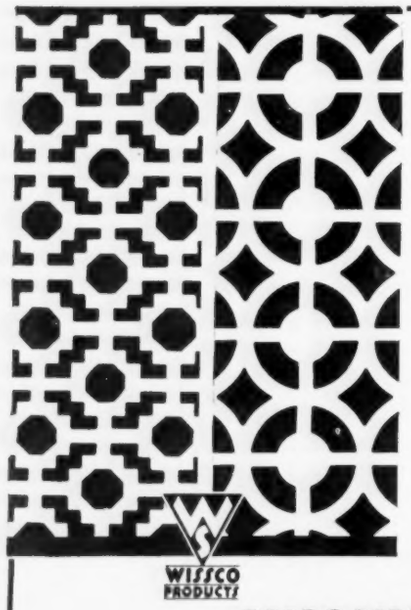
Additional Equipment News, page 10

Chicago—Demand for a number of types of machinery and plant equipment has yet to recover from the slump experienced early this month. Inquiries, however, are in steady volume and are expected to result in a recovery in sales in the near future. Interest in heavy steel mill equipment is centered on plans of the American Sheet & Tin Plate Co. for installation of a new hot strip mill at Gary. The expenditure for this and other equipment involves about $15,000,000. Several steel companies are considering machine tool purchases but definite inquiries have yet to appear. Tools on the recent list of the Santa Fe railroad still are pending, with inquiries from other roads lacking.

New lists of machine tools have appeared from the navy and also from the war department. Included in the latter are a number of tools for the Rock Island, Ill., arsenal.

New York—Orders for single machines from widely diversified sources are heavier while a fair volume of inquiry is active. Sheet metal working shops have ordered more equipment, notably shears. Inquiry by the Delaware, Lackawanna & Western railroad for new shop equipment, though small, is the first from eastern roads following a long period of inactivity. The company is taking bids on a portable, heavy-duty geared head lathe; one 36-inch turret lathe; one heavy-duty geared head screw cutting engine lathe; three portable electric welding sets; electric metal melting pot and a two-ton electric hoist.

Boston—Machine building shops are generally active on old orders, largely government requirements. Inquiry for plant equipment is fairly active, but buying is limited to one or two tools at a time. No large lists are out, but the aggregate volume already figured is substantial.



NEW DESIGNS

Increased free air openings and greater concealment are important features of the new Wissco designs in decorative perforated metals. A new folder showing them, as well as all other of the popular Wickwire designs is now ready.

Send for a copy.

WICKWIRE SPENCER STEEL CO.
New York City Worcester Buffalo
Chicago San Francisco

WICKWIRE SPENCER
PERFORATED METALS

Construction and Enterprise

For information concerning expenditures of $47,000,000 by the United States Steel Corp., $20,000,000 by Bethlehem Steel Corp., and programs of other steel producers, please turn to page 10 of this issue.

Ohio

CLEVELAND—Brown Fence & Wire Co., 6532 Juniata avenue, Frank Spitz president, is considering establishment of a branch in Parkersburg, W. Va., to produce ornamental and farm fence and steel roofing.

DAYTON, O.—Office of contracting officer, material division air corps, Wright field, will take bids March 4, circular 497, on 166 motor generators.

LORAIN, O.—American Stove Co. is making additional improvements to its plant here to cost more than $60,000. A large japanning oven will be installed, together with auxiliary equipment necessary to its operation. S. E. Little is vice president and sales manager.

NEW PHILADELPHIA, O.—Buckeye Tool & Machine Co., whose plant and equipment was purchased at a sheriff's sale by Henry Seibold, will be reorganized under the name of the Buckeye Machine & Supply Co. Other incorporators are John A. Seibold and Walter R. Ritter.

Michigan

ADRIAN, MICH.—Stubnitz Greene Spring Corp. has been incorporated with $100,000 capital stock to manufacture springs, by Daniel A. Greene, 2125 Detroit street, Flint, Mich.

DETROIT — Truscon Steel Co., Youngstown, O., has been awarded contract for a $19,000 steel storage house to be erected at the East Jefferson avenue plant of the Chrysler Corp.

GRAND HAVEN, MICH.—Michigan By-Products Coke Co. has been organized to manufacture bituminous and semi-bituminous coal, coke, gas and all by-products. A coke plant having a capacity of 300 tons of metallurgical coke daily and costing approximately $1,600,000 will be erected. Leo C. Lillie is president.

HULBERT, MICH. — J. Shepard Parish Co. is preparing private plans for rebuilding its plant damaged by fire. The proposed building will cost about $60,000.

JACKSON, MICH.—Macklin Co. is erecting a one-story factory addition, 40 x 100 feet.

JACKSON, MICH.—Consumers Power Co. has completed private plans for a $40,000 automatic transformer substation to be erected 2½ miles north of Sparta, Mich.

MT. MORRIS, MICH.—City has been granted PWA loan of $30,000 for waterworks improvements.

MUSKEGON HEIGHTS, MICH.—Private plans are being prepared for the rebuilding the boiler and engine room of the Norge Corp.'s plant here.

PORT HURON, MICH.—Lakeside Brewing Co. is planning to remodel the buildings on its property at Bard street and Michigan avenue for brewery use.

Indiana

BLUFFTON, IND.—Changes in the operation of the Bluffton Foundry & Machine Co., which include sale of some of the equipment, have been announced by William Moser, president. George Lautzenheiser will continue to operate a general machine shop business at the plant, and the manufacture of mascot stokers will be continued.

INDIANAPOLIS—L. C. Leavitt Inc., State Life building, Lawrence C. Leavitt resident agent, has been incorporated to manufacture stapling machines, by Lawrence C. Leavitt, Earl Liggett and George Hill.

Illinois

CHICAGO—White Cap Co., 1806 North Central avenue, manufacturer of metal caps for glass jars, is erecting a 100 x 120 two-story addition to its plant. The cost of the new building is estimated at $50,000. Campbell-Lowrie-Lautermilch Corp., Chicago, is general contractor.

CHICAGO—Arrow Metal Works Inc., 5843 North Artesian avenue, has been incorporated by Edward H. Kraus, Bernice W. Kraus and Edward H. Blatter, to manufacture and deal in tools, dies, jigs, machines and equipment. Correspondent: Frank J. Snite, 1106-08 South Dearborn street.

CHICAGO—Chicago Vending Co., 231 East Ninety-fifth street, has been incorporated to manufacture and deal in all types and kinds of coin machines, by Arthur Nelson, George Brovet and Harry Kampe. Correspondent: George Brovet, care of Chicago Vending Co.

Alabama

CORDOVA, ALA.—Stephenson Brick Co. plant, idle since 1930, has been reopened to manufacture 500,000 brick to be used in the Walker county almshouse. Forty men will be put back to work.

TUSCUMBIA, ALA.—City, W. L. Farr mayor, is seeking $350,000 PWA funds for public improvements, including construction of municipal light and power plant.

WARRIOR, ALA.—R. L. Mitchell, mayor, will take bids Feb. 27 for constructing waterworks system, including elevated steel tank, pumps and pump house and water treatment plant.

District of Columbia

WASHINGTON—Construction service, veterans administration, will take bids March 12, for a steel water storage tank at veterans administration facility, Hot Springs, S. Dak.

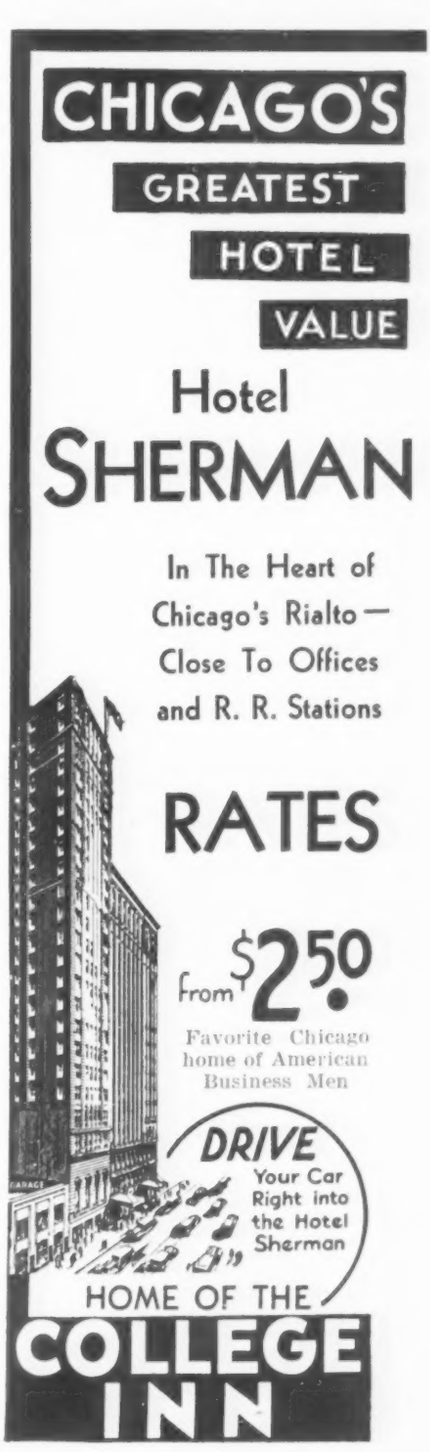
WASHINGTON—Bureau of supplies and accounts, navy department, will take bids March 5, schedule 4309, on four portable pumps, delivered Boston, six delivered Norfolk, Va.; two delivered Mare Island, Calif.; four delivered Puget Sound, Wash.; four delivered Brooklyn, N. Y.; and eight delivered Philadelphia.

WASHINGTON—Chief of ordnance United States army, will receive bids March 11, circular 22, one universal hexagon turret lathe, one horizontal boring mill, two universal horizontal milling machines, one hydraulic gear grinder, one automatic universal worm grinder, one hydraulic feed surface grinder.

WASHINGTON—Chief of ordnance, United States army, will take bids March 13, circular 27, one turret lathe, one wood planing machine, one horizontal milling machine, one gear grinding machine, one cylindrical grinder, one motor-driven metal plate shear, eight lathes; circular 26, one woodworking lathe, one gear shaper, one centering machine and one air compressor.

WASHINGTON—Chief of ordnance, United States army, will take bids March 14, circular 28, two vertical drills, two vertical shapers, five turret lathes, three horizontal boring, milling and drilling machines, one universal milling machine, one plain milling machine, four or six surface grinders, two surface grinders, one gun-boring lathe, one precision boring machine, and one universal circular table.

WASHINGTON—Chief of ordnance, United States army, will open bids March 12, circular 24, on one horizontal boring mill, one milling machine, one cylindrical grinder, one universal cylin-



drical grinder, one toolroom lathe, one swaging machine, two 2-base facing machines, four 4-base facing machines, one 6-spindle polishing machine; circular 25, one universal milling machine, one engine lathe and one precision lathe.

Florida

JACKSONVILLE, FLA.—City commission and Duval board of county commissioners have tentatively approved proposal of Union Bag & Paper Corp., Woolworth building, New York, to erect a paper mill, pulp mill and bag factory at Eastport, Fla., whereby the city would expend $300,000 for purchase of land for establishment of enterprise and Union Bag & Paper Co. would spend approximately $4,000,000 in constructing plants.

Georgia

LOUISVILLE, GA.—T. B. Kelly Lumber Co. planing mill recently sustained severe damages by fire.

Kentucky

LOUISVILLE, KY.—Plant of the Stiglitz Furnace Co., 2007 Portland avenue, recently was damaged by fire.

LOUISVILLE, KY.—United States engineer office, P. O. Box 59, will receive bids Feb. 27, for two 750-horsepower propelling engines, one 1600-horsepower dredge pump engine, and one 575-kilowatt generating set, all full diesel type.

North Carolina

DURHAM, N. C.—Durham Dairy Products Co., Memorial street, is planning to enlarge its plant. George W. Kane, contractor.

HIGH POINT, N. C.—City council has endorsed plans for permanent improvement, funds expected to be appropriated, including $300,000 for electric power system, $600,000 for grade crossing separation, $150,000 for city administration building, and $142,000 for schools.

LEXINGTON, N. C. — Piedmont Lumber Co., W. F. Brown, president, is planning to erect a woodworking plant.

WINSTON-SALEM, N. C.—Harry L. Shaner, commissioner of public works, will take bids Feb. 28 for erection of pumping station.

Tennessee

KNOXVILLE, TENN.—Director of purchases, Tennessee Valley Authority, will open bids March 7, for designing, furnishing, fabricating, galvanizing and delivering 664 steel transmission towers for Wilson dam-Norris dam transmission line.

Virginia

CHRISTIANSBURG, VA.—Town is planning to expend $250,000 for construction of power plant and $30,000 for filter plant.

LEXINGTON, VA.—H. B. Rice, superintendent of public works, is seeking $509,000 for public works project, including auxiliary water supply system, power plant, and sewerage disposal and incinerator.

Missouri

ST. LOUIS—City, Mayor Dickman, is seeking PWA funds for projects costing $120,000,000, including $20,000,000 for gas distribution system and $15,000,000 for coke manufacturing plants and central heating plant.

ST. LOUIS—B. & B. Combustion Equipment Co. has been incorporated by Eugene S. Bremmerman, 4452 Duncan street, and Otis O. Barr.

Texas

AUSTIN, TEX.—Tips Engine Works has been incorporated with $115,000 capital by J. A. Bachman and Walter Tips.

DALLAS, TEX.—R. & R. Mfg. Co. Inc., has been incorporated with $10,000 capital to deal in iron, steel and other metal products, by Floyd D. Roan, Grace Richardson and Virgil V. Richardson.

ELSA, TEX.—Southern Pacific Lines, Willis J. Carter, Harlingen, Tex., plans to rebuild the burned packing plant operated by F. H. Vahlsing Inc.

FORT WORTH, TEX.—Polk Co. has been incorporated with $10,000 capital by Samuel W. Polk and Turner B. Merrick, to manufacture oil well and refinery specialties. A plant will be established at 805 Bryan avenue.

HOUSTON, TEX.—Southern Container Co., 6037 Esperson street, will shortly start work on improvements to cost $75,000.

HOUSTON, TEX.—Filtrol Co. of California, J. W. Bell manager, 1755 Downey road, Los Angeles, has acquired a 21-acre site at Greens Bayou, near here, and will soon begin construction of a plant for manufacture of non-metal filters for use by refineries. Will expend about $300,000.

LITTEFIELD, TEX.—City, W. G. Street mayor, will take bids Feb. 28 for waterworks improvements, including 1-story power plant, pumping unit, etc. H. N. Roberts, Lubbock, Tex., engineer.

Wisconsin

APPLETON, WIS.—Miller Electric Mfg. Co. has been incorporated to manufacture electric products, by John Mulder, Niels C. Miller and Betty Miller.

BLAIR, WIS.—Moss Tie Co., Security building, St. Louis, has started construction of a saw mill here to be used for sawing ties.

MANITOWOC, WIS.—General Wheel Goods Inc. has been organized by Elmer and Allan Drumm and A. N. Dedricks, Manitowoc, to manufacture coaster wagons, toys, playground equipment and metal stampings generally.

MARSHFIELD, WIS.—Water and light commission, George Marvin secretary, will soon take bids for construction of an addition to the boiler house of the municipal power plant and for installation of new power plant equipment, including new boiler, auxiliary stoker, coal and ash handling equipment, boiler feed pumping equipment, etc. Ralph D. Thomas, 1200 Second avenue South, Minneapolis, is engineer.

MILWAUKEE—Beer-Rite Corp. has been incorporated by Julius M. Egerman, 757 North Broadway, Thomas Nigbor and Frederick Salentine, to manufacture apparatus for cleaning beverage dispensing units.

MILWAUKEE—Milwaukee Cooperage Co., P. L. Bajus president, has moved its business into the buildings formerly occupied by the Rauwald Sash & Door Co. at 3030 West Auer avenue. Equipment and assets of a stamping concern have been purchased by the company and will be moved into the new cooperage quarters. Facilities of the stamping department will be expanded to furnish work in slack seasons for beer barrels.

OSHKOSH, WIS.—Dunphy Boat Mfg. Co., Eau Claire, Wis., builder of wood and metal rowboats, cruisers, etc., is transferring its plant to this city.

RACINE, WIS. — Hamilton - Beach Mfg. Co. plans the construction of an addition to its factory.

STRATFORD, WIS.—Frank Curtis, city clerk, will receive bids until Feb. 28 for construction of a municipal waterworks system, including pump house, turbine pump, 4000 feet of 8-inch cast iron pipe and one steel surge tank 4 feet in diameter and 16 feet long. W. G. Kirchoffer, 22 North Carroll street, Madison, Wis., engineer.

Minnesota

HIBBING, MINN.—A bill has been introduced in the present Minnesota state legislature, now in session, to provide for the construction of a $250,000 mines building at Hibbing for the use of the experimental and mineral lands appraisal department of the school of mines of the University of Minnesota, division of forestry.

MINNEAPOLIS—Gluek Brewing Co., 2021 Northeast Marshall street, is having plans prepared for an addition and improvements to its brewing plant, including additional storage facilities. Stebbins, Haxby & Bissell, 1111 Nicollet avenue, are architects.

North Dakota

DICKINSON, N. DAK.—Dickinson Clay Products Co., Sam Zook general manager, will build a new machine house to hold all manufacturing and processing equipment. A new set of conveying equipment will also be installed.

Iowa

STORM LAKE, IOWA—Storm Lake Packing Co. has been incorporated with capital stock of $75,000 by H. L. Nash, president, and T. H. Nash, vice president and treasurer. The company will construct a packing plant to cost about $60,000.

WAVERLY, IOWA—Arrangements are being completed for funds to purchase new brewery equipment and machinery and for rehabilitating the old Heiberg brewery and getting it ready for operation. William Heiberg is president.

Nebraska

COLUMBUS, NEBR.—Loup river public power district, Harold Kramer secretary, will receive bids until Feb. 28 for furnishing three vertical shaft generators for the Columbus power plant and three vertical shaft generators for the Monroe power plant. Bids will also be received until March 5 on 95 tons of steel sheet piling, 210 tons of reinforcing steel and three cast iron gates with geared pedestal lifts.

NORTH PLATTE, NEBR.—Platte valley public power and irrigation district, Gerald Gentleman secretary, will receive bids until March 1 for a siphon across the South Platte valley, necessitating use of 1600 tons of reinforcing steel and wire mesh and 400 tons of steel for trestle.

Idaho

BONNERS FERRY, IDAHO—Bonners Ferry Grain & Milling Co. has been purchased by Boyd-Coulee Co., Spokane.

PERIN ENGINEERING CO., Inc.
CONSULTING ENGINEERS

Investigations, Reports, Development of Raw Materials, Ore Sintering, Coke Ovens, Blast Furnaces, Open Hearth and Electric Steel Plants, Rolling Mills, Power Plants, Cement Plants

535 Fifth Ave. NEW YORK
Cable Address PERINESTEP

Simonds Cut Gears
SPUR—BEVEL—MITRE & WORM—RACK CUT TEETH—SPECIAL MACHINERY . .

Treated gears—cut and finished by Simonds—last longer, eliminate costly shut downs and work smoother and more efficiently.
Made in all sizes for any service and TREATED to meet your refiuirements.

Also—
Ramsey Silent Chain Drives : Gates
Vulco Rope Drives : All Steel Silent
Pinions : Bakelite Silent Pinions

The SIMONDS MANUFACTURING Co.
25th STREET — PITTSBURGH, PA.

Producer Gas Systems

WE GUARANTEE RESULTS
Using Bituminous and Anthracite Coal, Raw and Scrubbed Gas, for Displacing Oil, City and Natural Gas Coal and Coke in furnaces of all descriptions.

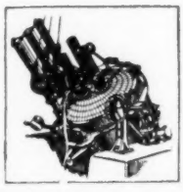
Flinn & Dreffein Co.
308 W. Washington St. Chicago, Ill.

SC&H Furnaces are made for annealing, case hardening, carburizing, forging, cyaniding, lead hardening & oil tempering.

STRONG CARLISLE & HAMMOND
1400 W. 3rd St., Cleveland, O.

SC&H Furnaces are built in all sizes of Oven, Pot, Continuous, and Special Types for Electric, Oil or Gas application.

HOLCROFT & COMPANY
LEADERS IN BUILDING AND DESIGNING ELECTRIC AND COMBUSTION FURNACES, KILNS AND OVENS.
HOME OFFICE: DETROIT—BRANCHES: CHICAGO, PHILADELPHIA
CANADA: WALKER METAL PRODUCTS, LTD., WALKERVILLE, ONT.
BUILT BY HOLCROFT & COMPANY DETROIT-MICH.



Moore Rapid LECTROMELT Furnaces
Standard Sizes 25 lbs. to 100 Tons Capacity
Most Rapid and efficient for making
Tool Steels, Alloy Steels, Forging Steels
Steel Castings, Malleable Iron, Grey Iron, Carbide, Ferro-Alloys etc.
PITTSBURGH LECTROMELT FURNACE CORP.
P.O. BOX 1257, FOOT OF 32ND ST. PITTSBURGH, PA. U.S.A.

To Economize Galvanize at Enterprise!
30 Years of Galvanizing for the U. S. Government
ENTERPRISE GALVANIZING CO.
2507 E. CUMBERLAND ST., PHILADELPHIA, PA.

JIGS — FIXTURES — SPECIAL MACHINES— PUNCHES—DIES—*"to your measure"!*

Let our trained engineers apply our 28 years' experience to your equipment problem. Our successes in other plants of all types, and proved methods assure a solution of any question involving production machinery. Write us in detail without obligation.

THE COLUMBUS DIE, TOOL AND MACHINE CO.
COLUMBUS, OHIO

STAINLESS STEEL SHEETS
AUTOMATICALLY POLISHED
ON
EXCELSIOR
STAINLESS STEEL POLISHING MACHINE
35-YEARS POLISHING MACHINE EXPERIENCE
ESTABLISHED 1892 — INCORPORATED 1902
EXCELSIOR TOOL & MACHINE CO
EAST ST. LOUIS, ILLINOIS.

244 Pages, 6" x 9"
116 Illustrations
9 Tables

The Manufacture of Steel Sheets
By Edward S. Lawrence

Describes sequence of operations in sheetmaking from manufacture of steel to finished sheet, with especial reference to production of high grade sheets for automobile bodies; influence of various methods upon quality of product and causes and prevention of defects are given attention; description follows current practice and is devoid of unnecessary technicalities.

THE PENTON PUBLISHING COMPANY
Book Department
1213-35 W. 3rd. St. Cleveland, O.

Price Postpaid $6.15 in U. S. and Canada 30s. 6d. in other countries

111-S

and the new owners plan to increase the warehouse capacity to 150,000 bushels and to install cleaning equipment, as well as increase mill capacity.

Pacific Coast

BURBANK, CALIF.—Warner Bros.-First National Pictures Corp. is having plans prepared to replace shop building recently damaged by fire. (Noted Dec. 10).

FRESNO, CALIF.—Borden Co. of California has a $15,000 improvement program under way at its plant at H and Tuolumne streets. Work consists of alterations to dairy buildings.

GLENDALE, CALIF.—Plans are being prepared for the construction of a garage and shop building to be erected on Howard street by the Glendale public service department. Cost is estimated at $40,000.

LONG BEACH, CALIF.—Long Beach board of education has approved completed plans for construction of gymnasium buildings and shop to be erected at Jefferson junior high school.

LOS ANGELES—A. R. Walker and P. A. Eisen, architects, 708 Pacific Commerce building, have prepared preliminary plans for construction of a group of buildings, consisting of hangars, shops and offices to be erected at the Los Angeles municipal airport for the T. W. A. Air Lines. Estimated cost $363,-580.

EVERETT, WASH.—Weyerhaeuser Timber Co. has begun wrecking mill B, one of its three sawmill plants here, and the site will be used for erection of a 150-ton daily unbleached pulp mill. Cost is estimated at $100,000. F. R. Titcomb is manager.

MONTESANO, WASH.—Plans are being completed for the proposed plant to be operated jointly by the Minnesota Valley Canning Co. and Wisconsin Canneries. Henry Robel is building engineer, and bids will be taken soon. Specifications provide for a warehouse, boiler house and produce building.

SEATTLE—Lembke Power Tool Co, Inc., 1902 Broadway, has been organized by Halford Lembke and associates.

SEATTLE—Seattle Gas Co. is expending $15,000 in improvements, including a 150-foot smokestack, hoods, purifiers, steam siphons, etc.

Iron Origin Points To Central Europe

(*Concluded from Page* 22)

cate that these immigrants from the East brought a knowledge of iron with them, but there is evidence for a belief that long before they arrived the Villanovan populations had worked the iron deposits of Tuscany and possibly those of the Island of Elba. Iron-working thus acquired was a developed Etruscan industry by 700 B. C.

One hundred years later, Etruscan armies overwhelmed Rome, and all of Campania and Latium became subject to the Etruscan kings. In a century of dominance which followed (616-510 B. C.) Roman civilization began to take form. Rude farm villages, rapidly expanding to cities, became thriving centers of trade where Greek, Punic and Massiliot merchants bartered their wares and "Corinthian artists and craftsmen found employment in the adornment of temples, palaces and tombs." Roman metallurgy, and the working of iron, unquestionably date from this period.

The expulsion by Rome of her Etruscan kings was seemingly followed by a general migration of the commercial and industrial classes; in any event, Republican Rome turned again to the soil, and for nearly 200 years communication and trade with the outside world are greatly diminished.

If, as many historians claim, it was land-hunger and density of population which forced Rome, in the fourth century, to attempt the subjugation of all Italy, it is not inconceivable that the first steps taken were part of a deliberate plan. It is significant of this that without adequate mineral resources of her own, Rome struck first at Etruria, the richest region of Italy in deposits of iron. From then (351 B. C.) until the end of the Second Punic War (201 B. C.) the mines of Elba and the celebrated Etruscan metallurgical centers, Populonia and Volterra, were the chief arsenals of the Republic.

Fostered Invincible Army

With an abundance of iron assured and with unlimited man-power to draw upon, it was a relatively simple task for the strong centralized government of Republican Rome to build up that irresistible army which, in the space of a hundred years, conquered Italy and forced Carthage to relinquish Sicily. In the century of conflict which followed (241-146 B. C.) Carthage was destroyed; Spain, Illyria and Greece became subject provinces; and Rome ruled supreme in the western world.

It must not be inferred that with the acquisition of the iron of Elba Rome abandoned the use of copper and bronze. On the contrary, iron never replaced those nonferrous metals for household utensils, implements of the simpler forms, and for articles of adornment or general utility. But from the fourth century onward, cutting tools, farm implements, and the like, are usually of iron, as are the swords, daggers, spear-points and arrow heads used by the army. Defensive armor, on the other hand —helmets, breast plates, mail, greaves—were usually of bronze; a fact readily accounted for by the many technical difficulties involved in hammering iron blooms into thin pieces or shapes.

Until the closing years of the Republic, Roman iron-working was Homeric in its rudimentary simplicity. Every commmunity had its local forge as in Greece of that earlier period. There is the same tendency, too, among the wealthy landowners to employ freedmen or slaves skilled in the working of iron. Varro, a contemporary of Caesar, tells of traveling smiths.

Nothing better illustrates the primitive character of the iron industry in Republican Rome than those surviving monuments which depict the community forge with its meager equipment, and the racks of cutlery and tools along the wall ready for sale direct to the householder, farmer or artisan.

In many respects, however, the iron industry of early Rome differed materially from that of the Homeric Greek world. From its very inception there seems to have been superficial knowledge, at least, of mining and of the refining of ores. Then, too, an almost continuous warfare necessitated huge standing armies, hence a considerable part of Rome's ironworkers were always afield with the legions.

Industry Gradually Socialized

Presumably it was military necessity which in the second century B. C. led to a concentration of ironworking at such points as Puteoli, Syracuse, Rhegium, Sulmo and Venafrum, in addition to those older, and then thriving centers of Populonia, Volterra and Minturnae. The way was thus paved for government participation in the last years of the Republic and ultimately for state control and operation of arsenals under the Empire.

It was in the first half of the Empire that the mineral resources of Europe were really exploited to meet the growing demands of a Roman world. Iron, which under the Republic had been supplied chiefly by the mines of Elba and those of Spain, in the days of Hadrian (117-138 A. D.) was coming also from Gaul, Britain, Noricum, Illyria and Thrace. Not that much of the iron produced in those regions actually appeared on the market at Rome; that output, indeed, was almost wholly absorbed by the enormous arms factories long since established at strategic points near the various mines.

That Roman iron-making did not progress greatly beyond broadening the field of industrial application is due largely to the abundance of cheap labor and a traditional contempt of the ruling classes for industry in general. Man-power, capital, and a directing intelligence capable of technical advance far beyond the inherited primitive methods were always available in the Roman state. But labor alone could not be expected to supply the necessary initiative; capital, otherwise actively engaged or indifferent, would not; and the task of revolutionizing the iron industry passed to Europe of the late Middle Ages.

(*To be concluded*)